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What Price Collaboration?

WILL Great Britain and the United States be partners in the tremendous venture of the supersonic airliner? Or are they sparring for an ugly slogging match? Sir George Edwards said the other day that when he was in America he put the proposition that both the supersonic transport and international collaboration were good things. "They were not unsympathetic," he added. Sir George expressed himself as terrified at the Americans' concern over what the Russians were going to do. If the USSR decided that they wanted to make an all-out attack on the airline and aircraft manufacturing industries of the West, he believed, then the cheapest way in which they could bring chaos to both would be to produce a "so-called supersonic transport flying at an alleged 2,000 m.p.h." [Mach 3]. If we fell for this one and got ourselves into a kind of sputnik panic, then we should deserve everything that happened to us.

Among the Americans who expressed themselves as "not unsympathetic" with Sir George's views, Mr James T. Pyle, Deputy Administrator of the Federal Aviation Agency, does not appear to have been numbered. Mr Pyle points out that the results of the B-70 development and flight-test programme will provide technical data that will be directly applicable in the development of a civil supersonic transport. "I expect to see a supersonic transport either in the air or approaching operational use by the end of this decade," Mr Pyle announces. "And quite frankly," he proclaims, "I hope to see that the United States is first in producing a successful design." Mr Pyle makes it quite clear that the aeroplane he has in mind will cruise in the region of Mach 3.

A Question of Range

Mr R. J. Patton, Convair's senior propulsion engineer, is a little more specific. He says that for 3,500 miles and greater Mach 3 would appear to be desirable; but for the shorter ranges very little is gained in going from Mach 2 to Mach 3. Mr Patton's views command respect, for Convair were the first constructors of a supersonic bomber. It is one thing, however, to build a Mach 2 bomber or fighter and quite another to build a public transport vehicle having the same or greater performance. Sir George Edwards reminds us, "By virtue of a lot of concentrated work the British just about know how to do the slower one [Mach 2] and I think have every intention of doing it. The Americans could undoubtedly find out how to do it. Neither of us knows how to do the 2,000-m.p.h. one [Mach 3]."

Sir George's confidence that Britain at present holds the lead stems from the concerted study undertaken in this country during recent years into feasibility and design characteristics. Sir Frederick Handley Page has just had something very interesting to say about this work—something more tangible than artist's impressions (especially of the kind said to be produced in the public relations office). In association with several other British constructors, he says, his company are carrying out structural and aerodynamic research on supersonic civil aircraft. "We have concentrated," Sir Frederick says, "on the study of detailed aspects such as testing flexible models in our wind tunnels and on the study of an entirely new wing shape—a very slender delta—in order to choose the best position for fins, rudders and other control surfaces." Having mentioned the HP.115, which is linked with this programme, Sir Frederick adds that with laminar flow a "supersonic arrowhead-shaped airliner" would add half as much again to its London - New York payload.

In all this there is much that is interesting and exciting; but of the collaboration for which Sir George found American sympathy, and for which the MoA have asked in placing a design-study contract, there is no shred of evidence.

FROM ALL QUARTERS

New Thunderbirds

VISITING British Aircraft Corporation's English Electric guided-weapon plant at Stevenage on November 7, Mr J. Profumo, Secretary of State for War, said: "The Army must have the best possible anti-aircraft protection to meet the challenge of modern war. We believe that Thunderbird answers this requirement better than any other system. The Government have, therefore, decided to authorize the completion of the development of this sophisticated weapon and, provided everything goes as well as up to the present, we intend the British Army shall be equipped with a new mark of this weapon as soon as possible."

Thunderbird 1 cost approximately £27m to develop, and equips 36 and 37 GW Regiments of the Royal Artillery. During the past few weeks, 36 GW Regt has achieved excellent results against drone targets at a practice camp in Anglesey. Thunderbird 2, discussed in our September 16 issue, incorporates CW radar and many other improvements.

The Queen's Near Miss

A WEST GERMAN Defence Ministry spokesman stated in Bonn last Monday that British and German officials had failed to reach agreement on the wording of an announcement about the alleged "buzzing" by West German fighters of the Comet in which the Queen was travelling from Copenhagen to London on October 25. The spokesman, Col Gerd Schmueckle, said that a statement was now expected "on Wednesday or Thursday." Asked if it remained true that no further action would be required from the German side, the colonel replied: "Absolutely right."

Gladiatorial Exit

LAST of the 527 Gloster Gladiators surviving, K8032 was handed over to the Shuttleworth Trust last Monday. It was flown from Brockworth, Glos, to Old Warden, Beds, by the Gloster chief test pilot, Wg Cdr R. F. Martin, bearing the insignia of No 72 Sqn.

At Brockworth, the Gloster chairman, Mr Hugh Burroughes, officially handed over the aircraft, with a parchment deed, the log-books and a substantial endowment, to Air Cdre Alan Wheeler, trustee of the Shuttleworth collection. Mr Burroughes paid tribute to the Gloster apprentices who had rebuilt K8032 more than twenty years after the aircraft went out of production, and to H. P. Folland and his No 1 assistant H. P. Preston, who led the design team when the Gladiator was produced in the early 1930s. The prototype flew for the first time in September 1934, and Gladiators were in service with the RAF throughout the Second World War.

More Money for B-70

ALTHOUGH it seems increasingly unlikely that the North American B-70 Valkyrie will ever see active service as a bomber, its development will benefit greatly from last week's release of additional funds. It may be remembered that in December last the Department of Defense, under strong pressure from the Bureau of the Budget, cut to approximately $75m the B-70 appropriation for Fiscal Year 1961 (ending next June 30). The entire programme was "reoriented" as a prototype-aircraft exercise, the essential military subsystems were all cancelled, North American pulled back all the widespread airframe subcontracting into their own Los Angeles plant and the first flight was put off from 1962 to the same date the following year.

On November 1 the Defense Department raised the Fiscal 1961 appropriation to $265m. It seems certain that this substantial release of funds is aimed principally at improving America's competitive position in the race to produce an M3 airliner. It would probably not be feasible to produce a direct transport version of the B-70, but the value of the aircraft as a research tool will be enormous. The recent MoA study contract to British Aircraft Corp is likely to hasten still further the decision of the US Government to sponsor a competitive programme, put out to industry by the Federal Aviation Agency and monitored technically by NASA.

***WEIGHT-SHIFTING:** "Flight's" first solo on a ground effect machine was made last weekend after assembly of the AirRhoCar, an air-curtain vehicle of this type constructed by Rhoades Inc of Pittsburgh and brought to Great Britain for the Motor Cycle Show at Earls Court by our associated journal "The Motor Cycle." Power is supplied by a 250 c.c. in-line twin and control is by adjustable vanes in the annular duct and by "leaning" to incline the platform*

VTO for NATO—

NATO's first-generation attack aircraft is the Fiat G.91, and it has always been assumed that it would be replaced by an STOL/VTOL machine. For use from 1965 onwards the Standing Group arrived many months ago at a basic formula for a new multi-mission strike vehicle. Whether or not the aircraft will be required to carry all-weather fire control appears to be still open to doubt. Vertical take-off is not demanded, but the aircraft must be capable of using an unprepared strip some 200m in length at maximum overload weight, and of being able to rise or descend vertically at reduced weight. Supersonic speed (not less than M1.5) is required only at altitude. The following are some of the projects currently in hand to meet this requirement:—

France: A 15,000lb Breguet project powered by a Bristol Siddeley BS.53 (17,500lb dry) used for both lift and thrust; a VTOL derivative of the Mirage III, retaining the same wing but having a wider and longer fuselage to accommodate a battery of six Rolls-Royce lift engines and a single RB.146 (17,000lb with reheat) or RB.168 (15,500lb) for propulsion; a supersonic Nord project, exceedingly small in size, with a delta wing and a single BS.53 for lift and propulsion; and a Sud design, with a maximum Mach number of 2, with six Rolls-Royce lift engines and a Pratt & Whitney JTF-10 for propulsion.

Germany (West): Nord Gruppe (Weser and Hamburger), a "paper" design weighing some 16,000lb, based on a single Pratt & Whitney TF33 or JTF4D-3 for both lift and propulsion; Entwicklungsring Sud (Messerschmitt as chief airframe designer, supported by Bölkow and Heinkel), a well advanced design for an M3 aircraft powered by several Rolls-Royce RB.153 turbojets, the gimballed mountings of which may be developed in association with Bell Aerosystems Co, whom Sud have asked to assist them as a result of the American firm's experience with swivelling engines in the defunct D-188A project.

United States: Boeing, a variable-sweep design, based on the study programme for the US Air Force noted below; Lockheed, two derivatives of the F-104, one with four GE turbojets (advanced versions of the J85) pivoted at the wing tips to provide lift, and another with no fuselage engine at all but relying on tip-mounted engines entirely; Republic, two versions of the F-105 fitted with lift engines, together with an entirely new project which has been under investigation since 1954 submitted jointly with Fokker, Republic's European associate.

—And for the USAF

IN October 1959 the US Air Force Tactical Air Command issued SDR-17 (system development requirement), which has since given rise to more research effort among likely contenders for an eventual contract than any other American project for a manned aeroplane. Money is being put into the programme through RS-649C (research support). In spite of their epithet "tactical," TAC are said to have demanded a range of 3,500 n.m. at altitude, leading to an aircraft roughly three times the weight of that needed by NATO. Boeing (*Flight*, September 2, page 318), Douglas, Hiller (tilt-wing), Lockheed, North American Aviation and Republic are all working on SDR-17. In addition Bell Aerosystems are believed still to be engaged in this field, notwithstanding the cancellation of the D-188A more than a year ago. Earlier this month Republic said that their entry had consumed $5m over the last five years, and that it would incorporate variable-sweep wings.

It is highly significant that the Boeing and Republic entries in SDR-17 are both variable-sweep aircraft based upon NASA research, which was in turn based on the work at Weybridge of Dr B. N. Wallis, chief of aeronautical R & D for Vickers-Armstrongs (Aircraft). Apart from a vague suggestion that the Wallis "Swallow" formula was to be used as the basis of a 50,000lb strike study for the Royal Navy (which appears to be dead), no use has been made of variable-sweep configurations in this country—unless this is the secret of the TSR.2.

***PIPER PAIR:** Subjects of a news item on this page are the Piper Cherokee (top) and Colt (lower)*

RAeS Lectures

TWO important lectures have been announced by the Royal Aeronautical Society, to take place on November 18 and 21 at the Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1. Both will begin at 6 p.m.

On the latter date (November 21), with Mr Peter Masefield, immediate past president of the Society, in the chair, Sir Thomas Sopwith, Honorary Fellow of the Society, who this year completed 50 years in aviation, is to give the inaugural lecture of the historical group of the Society. He will be speaking on his first ten years in aviation. This lecture was to have been given on May 17 but was postponed because he was indisposed.

Sir Thomas will be recalling many of the people, places and events of the years 1910-1921. He will refer to the beginning of the Sopwith Aviation Co, its first machines and the formation of the Hawker Engineering Co, forerunner of the Hawker Siddeley Group, of which he is chairman.

The November 18 lecture is being given by Mr J. R. D. Tata, chairman of Air-India International and a founder of Indian civil aviation. Under the title *The Story of Indian Air Transport*, Mr Tata will trace the history of air commerce in India from its beginnings in December 1931 to its present operation of jet aircraft and co-operation in international pool operations.

Cherokee and Colt

TWO new names have been added to the tribe of Pipers. The first —Cherokee—has been bestowed on a new all-metal low-wing four-seater featuring, the makers say, docile flight characteristics and particular simplicity. A Lycoming O-320-B engine of 160 h.p. will confer a cruising speed in excess of 130 m.p.h. Empty and gross weights are, respectively, 1,185lb and 2,200lb, and the price has been set at $9,995. The first production Cherokee is due off the line in February.

The name Colt has been given to a new low-priced two-seater along Tri-Pacer lines. Powered with a Lycoming O-235 engine of 108 h.p., it will sell for $4,995 and will cruise at 115 m.p.h.

Apart from the standard Colt, Piper are offering Custom and Super Custom models selling, respectively, for $5,995 and $6,995. Both models differ from the standard type in instrumentation and equipment.

Figures issued for a Super Custom Colt include the following: span, 30ft; wing area, 147 sq ft; cruising speed (75 per cent power), 115 m.p.h. at 7,000ft; stalling speed, 54 m.p.h.; take-off run, 950ft; landing run, 500ft; service ceiling, 12,000ft; cruising range (standard fuel, 75 per cent power at sea level), 324 miles.

Handley Page Review

ABILITY of the Victor B.2 to carry Skybolt, and supersonic and laminar flow research, with news that the H.P.115 is to make its first flight "shortly," were points stressed by the chairman of Handley Page Ltd, Sir Frederick Handley Page, in his review of the year ended December 1959.

On the Victor, Sir Frederick says: "You may have my assurance that the Victor 2 . . . can carry Skybolts without either wing strengthening or undercarriage modification. Already it has flown with the equivalent (in weight and drag) of two Skybolts under its wings. These facts are known by our defence chiefs. Britain's Minister of Defence, however, has said that no decision has yet been made to equip Victor bombers with Skybolts and that instead it may be decided to fit a comparable British-built weapon. In making these decisions he will be conscious of the effect on RAF Bomber Command's operational flexibility if only one type of V-bomber is equipped to carry Skybolts in the years ahead."

Referring to research, Sir Frederick says that Handley Page work "is aimed at the two basic requirements for the future: sophisticated supersonic airliners; fast subsonic aircraft capable of competing economically with surface transport." The company had made a series of studies of practical aeroplane designs, and in addition to this general approach had concentrated on detailed aspects such as the study of an entirely new wing shape, "a very slender delta." The H.P.115 single-seater research aircraft is described as having a slender, low-aspect-ratio delta wing. It is powered by "a small jet engine"—actually a Bristol Siddeley Viper.

Sir Frederick says that the company's design teams are developing "very large laminar-flow airliners." He comments that "laminar flow is also effective at speeds above that of sound. For example, laminarizing a supersonic, arrowhead-shaped airliner will add half as much again to its payload on, say, the London - New York route. Alternatively, it could take the same payload but fly about one-third as far again." Under the aegis of the MoA, the company are converting a Lancaster to investigate laminar flow as applied to swept wings.

The Handley Page Ltd trading profit, £572,782, shows an improvement over the previous year; and the net profit, £151,403, after providing for taxation shows an improvement of £61,372. Reference to Herald development costs was made in last week's issue (Air Commerce, page 697).

IN BRIEF

Stornoway Airport is to be developed as a NATO air base. It is not expected that BEA operations will be affected while work is in progress.

David Lockspeiser, the Hawker Aircraft test pilot, has been loaned to Blackburn Aircraft to assist in Buccaneer development flying while "Sailor" Parker is recovering from the effects of his recent high-speed ejection.

Salvage operations for the Victor B.2 which went into the sea off the Pembrokeshire coast in August last year are to end shortly. Cost of the search, which has resulted in the recovery of 500,000 pieces of wreckage, is stated to be £1,500,000.

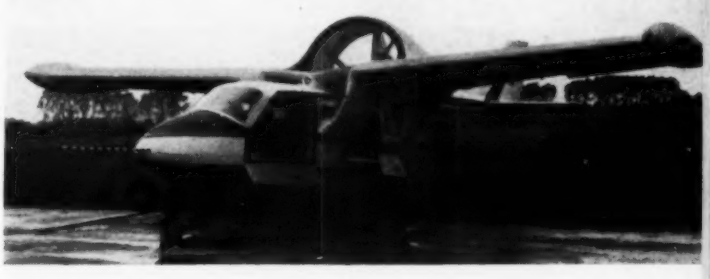
Mr C. A. Chapman, a London-born engineer who joined Lockheed as a design engineer nine years ago, has been appointed vice-president of sales for Lockheed Aircraft International. He was with Handley Page Ltd until 1950.

Douglas Aircraft announce the appointment of C. C. Martin as "representative in the United Kingdom for defense programs." To be stationed in London, he will co-ordinate several activities, most important being GAM-87A Skybolt.

The aerial "at home" being held tomorrow (Saturday, November 12) to demonstrate the latest range of Cessna aircraft will be at Honeydon airstrip, near Colmworth, Beds, instead of at Bedford (Castle Mill) as originally announced. The strip is by the Colmworth - St Neots road, at 52°13′N 00°21′W. Hosts are W. H. & J. Rogers (Engineers) Ltd, Great Barford, Bedford.

International Plastics Engineering, a new Associated Iliffe Press publication, is to make its first appearance on February 1 next year. A monthly (price 3s 6d), it will be devoted entirely to the engineering aspects of the plastics industry.

(*Further "From All Quarters" news appears overleaf*)



***GERMAN STOL:** Powered with two 250 h.p. Lycoming engines, this RF 1 six-seater STOL aircraft has been constructed by Rhein-Flugzeugbau. Flight trials are under way, and the makers are withholding performance figures until these are completed*

FROM ALL QUARTERS . . .

504 REPLACEMENT: Not a picture from "Flight's" archives of the 1930s, but a reader's snapshot of the Avro Tutor now in the Shuttleworth Collection—resplendent in bright yellow with polished cowlings. The Tutor succeeded the Avro 504N as the RAF's standard trainer in 1932 and was powered with an Armstrong Siddeley Lynx

Too Early to go Beagling

SINCE anouncement of the formation of BEAGLE—British Executive and General Aviation Ltd—conflicting reports have appeared in the daily press as to the price and seating capacity of an executive aircraft to be built by the new company. The most recent, which appeared last week, refers to a 4-5 seater costing about £20,000. Earlier reports spoke of a five-seater costing £25,000. No details as to the price or configuration of the aircraft have been released by BEAGLE, who say that the company's intentions are not confined to one individual aircraft type, that neither prices nor seating capacity have as yet been finally settled, that the design team is still being formed, and that it is not possible at this early stage to say more.

BEAGLE's interest in Rolls-Royce-built Continental engines —both for the Executive and for Auster/Beagle aircraft—was recorded in last week's issue.

The BAC-107's Powerplant

RECEIVED after our Correspondence page had closed for press are the following informative comments on Stanley Brogden's article, "Ansett and TAA Ideas on the Jet Airliner," published in last week's issue. They are from Mr Guy T. Smith, area sales manager, Bristol Siddeley Engines Ltd:—

"May I congratulate Mr Stanley Brogden on his most illuminating and, for the most part encouraging, review of the prospects of British civil jet aircraft in Australia? Uninhibited and objective descriptions of current airline thinking in potential markets are very welcome indeed.

"There is, however, one point in that part of Mr Brogden's review dealing with the BAC-107 which I should like to challenge. The opinion is attributed to the technical director of TAA, Mr John L. Watkins, that 'the trouble with the BAC-107 is the engine [the Bristol Siddeley BS.75], which is not even turning over yet.' Mr Watkins, for whose knowledge and experience we have the greatest respect, is reported as saying he does not see how any manufacturer can promise to have a brand-new engine operating adequately three years after its first run.

"There is, of course, no dispute that several engines have proved in the early days of their service in civil aircraft to have needed much more development, but in practically all such cases the engines concerned were completely new in all major respects. These considerations do not apply to the BS.75, which though itself a new engine employs to the fullest possible extent component designs based directly on experience gained with fully proven engines. For example, the four-stage turbine of the BS.75 is almost precisely the same size as the similar turbine in the Proteus (which, incidentally, already has an approved life between overhauls of 2,400hr); it is made of the same material and its operating temperature is no higher. Other features of the BS.75 are based on the design of corresponding components in the Olympus, the Sapphire and the BS.53. In fact, the BS.75, although its performance is so outstanding, is by no means an experimental engine.

"Mr. Watkins may also be reassured to know that the basic design of the BS.75 was settled so long ago as September 1959. Thus the whole development period envisaged for the engine is about five years. In the present state of the art this is by no means an over-short period for a moderate-sized engine based directly on experience gained in other proven engines."

Aviation Art at the Kronfeld

A RECORD number of entries—51 amateur and 16 professional —were on view at this year's Kronfeld Club art exhibition, opened and judged by Roy Nockolds and David Shepherd on November 2. The exhibition continues until 10 p.m. tonight (Friday).

For competition purposes the amateur entries were divided into two categories, for gliders and powered aircraft. The former section was won by Ann Welch (oils) and B. K. Skorupinski (other media), Mrs. Welch for a ground-handling scene titled *Pushing* and Skorupinski for a sketch of the Lasham clubhouse.

NAVIGATOR EXTRAORDINARY honoured at the Royal Aero Club dinner reported below is Mr Francis Chichester (left), winner of the recent solo transatlantic yacht race. With him are (left to right) Air Cdre A. H. Wheeler, Mr Peter Masefield and Col R. L. Preston (see news item, "Francis Chichester Honoured")

Harry Cooper, an Air Ministry information officer, and Miss Yvonne Middleton were successful in the powered-aircraft section. Mr Cooper's oil painting depicted a trio of Gloster Gladiators of 72 Squadron in 1938 and was named *Fun, Wasn't It?* and Miss Middleton's water colour was *November Oscar*.

Commended entries comprised *Small Club Site* by V. H. Veevers, *West of Dartmoor* and *Cross-country* by Ann Welch, and *Hunter* by Charles Hall, which also received the prize for the best entry by a first-time exhibitor. Other pictures included several characteristic pieces by John Stroud and John Blake, an inverted Bulldog and an inverted Gladiator by Dudley Jones, four originals of Gordon Horner sketches which first appeared in *Flight*, and an effective pattern titled *Cross-country* by Mrs Margaret Kahn.

Francis Chichester Honoured

NAVIGATING SKILL and endurance of a high order were honoured by the Royal Aero Club on Wednesday, November 2, when the guest at a Club dinner was Francis Chichester, pioneer air navigator and more recently winner of the solo transatlantic yacht race. Among Mr Chichester's notable feats of air navigation recalled by the chairman, Mr S. Kenneth Davies, were the 1929 solo flight from Britain to Australia in a Gipsy Moth; the first east-west crossing of the Tasman Sea from New Zealand to Australia in 1931; and subsequent flights from Australia to Japan and from Sydney to London via Peking.

What precisely was the appeal of this year's "one-man trans-atlantic sail race," as the Americans phrased it? Mr Chichester insisted that he could not really give a clear answer, but his modest account of a fantastically difficult voyage was enough to prove his own high courage and to give a glimpse of the immense satisfaction

GUEST OF HONOUR at a recent D.H. gathering in London was Mr J. C. C. Taylor (centre), for many years aviation sales manager of Shell-Mex & BP. The occasion was the annual dinner of the D.H. Technical School Old Boys Association. On the right is Mr F. T. Hearle, Sir Geoffrey de Havilland's first colleague 52 years ago, and a founder of the D.H. companies and of the Technical School. At left is Capt "Jerry" Shaw of de Havilland, one of Britain's first airline pilots, now concerned with D.H. airliner business. Also at the gathering was Mr R. E. Hardingham, chief executive of the ARB

which completing and winning the race must have provided. Sailing through fog for 1,500 miles; soaked to the skin for 37 days; mildew on the cabin floor, on his books, on his clothes; tacking because of headwinds for 37 out of the 40 days; coping with the Atlantic current, constantly against him; getting out to change the headsail time and time again, and being knocked about so much in the bunk by storms that one woke up much more tired than before turning in: Mr Chichester summed it all up with quiet understatement—"It wasn't really comfortable."

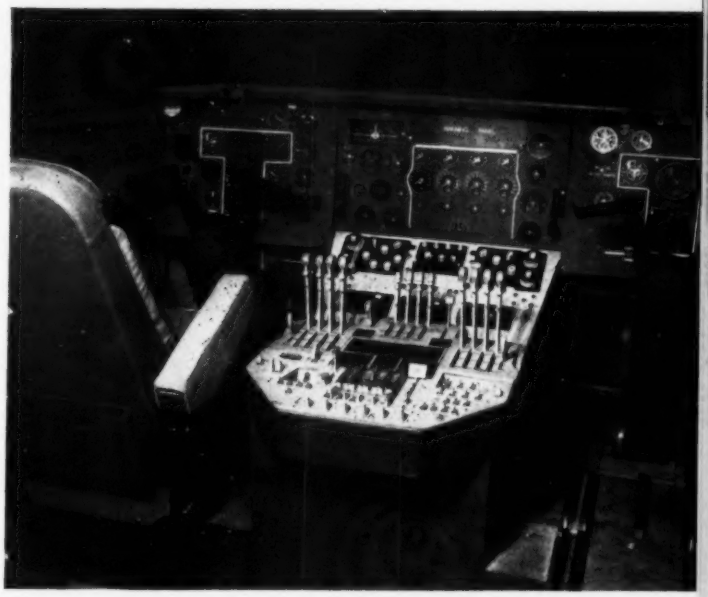
His introduction to sailing, the 59-year-old speaker recalled, came after the war and after he had formed his own map-making firm. After the hundreds of thousands of words he had written on the subject of navigation while at the Air Ministry, "I thought I was home and dry." But the nostalgia built up; "I had been squeezed out of the air. I really missed my navigation. So I thought of the sea." His yacht he named *Gipsy Moth 2*, on the suggestion of Mossie Preston, and with her he learned a lot about sailing. On one occasion prior to entering hospital he saw a notice concerning a single-handed Atlantic race: "But I turned up two years later and the notice was still on the board. I thought 'Here's a race. Three thousand miles on your own. My God, what a race'."

AUTOMATIC LANDING FOR THE BRITANNIC

THE accompanying photograph and drawing are the first to show the layout of equipment and controls concerned with navigation and automatic landing in the Short Britannic military freighter, which is to go into RAF service in 1964. Shorts point out that they have considerable experience of automatic controls by virtue of their development of drone Canberra U.10s and, particularly, of the triplex control system of the SC.1 The automatic landing equipment will, in the Britannic, be the Smiths SEP.5 autopilot—the triplex system already destined for the D.H. Trident—together with Murphy Leader Cable receivers and Standard Telephones & Cables radio altimeters. Pure navigation equipment will include duplicated Marconi AD.2300 Doppler radar and Tacan—as well as the VOR and ILS capability implicit in the normal VHF radio packages. Both HF and UHF radio will supplement VHF for communications.

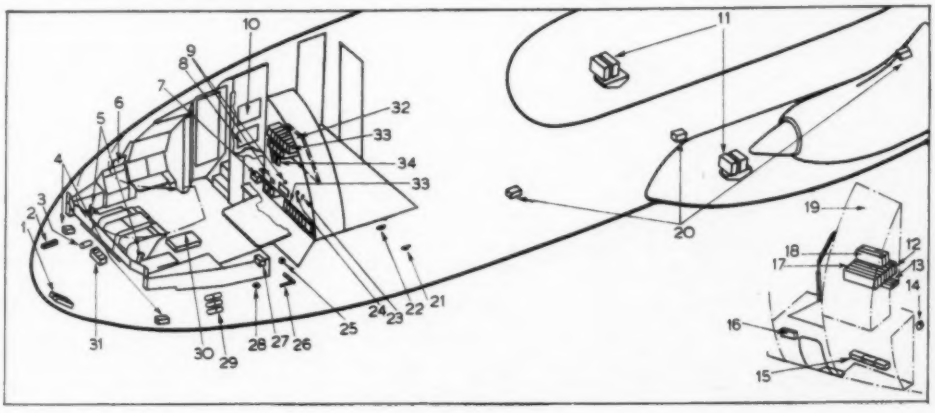
A significant factor in the information given in these drawings is the mixture of triplex, duplex and duplication in the overall system. Flight references, azimuth and pitch autopilot channels, Trident—together with Murphy Leader Cable receivers and radio altimeters are all triplex, but the VHF radios, compass systems, rudder controls and rudder autopilot amplifiers, air data computers and true airspeed computers are variously duplex or duplicated. The ailerons have a single triplex actuator mounted centrally. There is a single throttle computer, two amplifiers and individual servos for each throttle lever. All control surfaces have position pick-offs, those for ailerons and elevator being triplex and located at the surface while those for the rudder are duplex and located forward beneath the cockpit floor with the trim control. Three rate-gyro and sideslip-monitor units are grouped in the port side of the fuselage, between the spar frames; the vertical reference units are in the flight deck area.

Here, the communications and navigation radio and the three Leader Cable controllers are on the centre console (with small left/right needler), ahead of the throttle. In front of each pilot is the new Smiths instrument group, while the autopilot controller is on the console aft of the throttles. The radio altimeter dials which also form the sequence indicators for automatic landing are included in the main flight-instrument groups. Above the engine instruments is a central warning panel containing groups of primary, secondary and advisory warning indicators. Not all the instrument positions appear to have been included in the mock-up illustrated.

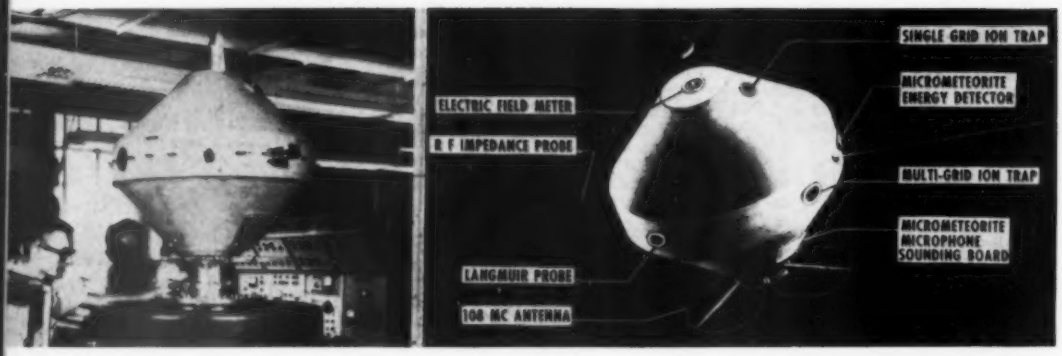


Britannic cockpit mock-up, showing the Smiths Flight System instruments in front of each pilot, HF, VHF and UHF radio and Leader Cable receiver controls ahead of the throttle and Smiths SEP.5 autopilot controller aft of them. Access to the seats is outboard and each pilot will have a nosewheel-steering tiller on his outboard control panel

1, Two ILS glide-path aerials; **2**, ILS localizer aerial; **3**, two elevator-trim servo motors, under pilot's floor; **4**, coupled localizer aerials; **5**, autopilot cut-out switches on control wheels; **6**, Flight System control panel; **7**, triplex vertical references; **8**, radio junction-box; **9**, Tacan control and indicator; **10**, fuse and distribution panel for Flight System; **11**, Doppler aerial, transmitter/receiver and tracker in each undercarriage fairing; **12**, two ILS/VOR receivers, glide-slope receivers and ILS/VOR instrument drives; **13**, three radio-altimeter amplifiers; **14**, static port in starboard fuselage skin; **15**, three inverters; **16**, Tacan transmitter/receiver; **17**, three Leader Cable receivers; **18**, two ILS marker receivers; **19**, radio rack; **20**, three pairs of radio-altimeter flush aerials; **21** and **22**, marker aerials; **23**, navigator's altimeter; **24**, navigator's a.s.i.; **25**, static port in port fuselage skin; **26**, pitot head; **27**, Tacan coupler; **28**, front Tacan aerial (another under rear fuselage); **29**, three Leader Cable aerials; **30**, manual override and trim detector for aileron and elevator channels, and synchro position transmitter and trim detector for rudder channel; **31**, four throttle servo-motors; **32**, flight control system junction-box. **33**, two amplifiers each for flight compass and attitude display; two variation-setting units; one flight-director pitch computer; triplex autopilot azimuth and pitch-control computers; triplex aileron and elevator channel amplifiers; duplex rudder-channel amplifier; elevator trim amplifier; throttle computer with two amplifiers; two air-data computers; two true-airspeed computers; twin directional-gyro units. **34**, two master compass units (senser in each wing-tip)



Diagrammatic view of the equipment layout in the nose of the Britannic, up to the No 2 engine nacelle and the undercarriage fairings containing the two Doppler radars. On the right is a view of the radio and equipment bays on the starboard side. Items are listed in the key above



The successful launch of the Explorer 8 ionospheric measurement satellite on November 3 is reported below. Far left, the Explorer package undergoes a pre-launch vibration test at the Marshall Space Flight Center, Huntsville; left, an artist's impression indicating the main experiments which the satellite carried. Weighing 90lb, Explorer 8 is 30in in diameter and 30in high

Missiles and Spaceflight

SPACE AND THE UNITED NATIONS

In a public lecture on *The United Nations and Outer Space* at University College, London, on November 3, Dr Bin Cheng, lecturer in international law and air law, called for a new approach in the United Nations to the problems of outer space. He strongly criticized the conclusion of the United Nations *ad hoc* Committee on the Peaceful Uses of Outer Space to the effect that there was no great urgency in defining the upper limits of national sovereignty. The *ad hoc* committee, he suggested, had deliberately sought to evade political and military issues.

Dr Cheng considered that, while problems of a political or military character should be referred to the disarmament talks now carried on under the auspices of the United Nations, no time should be wasted in establishing an intergovernmental agency to co-ordinate the activities of States in the peaceful exploration and exploitation of outer space on the technical level. He felt sure that if, in formulating the constitution of such an agency, the United Nations were to admit frankly the political and military implications of space exploration and to give them due weight, the major space powers would be far more ready to give the United Nations their effective support, instead of merely paying lip-service as hitherto.

EIGHTH EXPLORER

An ionospheric measurement satellite, named Explorer 8 and weighing 90lb, was successfully launched into orbit by Juno 2 from Cape Canaveral on November 3. Its initial orbit was stated to have an apogee of 1,450 miles, perigee 215 miles and period 112min.

Among the instruments carried are a radio-frequency impedance probe to measure electron concentrations in the ionosphere; a single-grid trap and four multiple-grid traps to measure the number and distribution of ions in different areas; a Langmuir probe to measure electron temperature; a photomultiplier to measure light energy and erosion effect of micrometeorites; a microphone to determine the speed and frequency of micrometeorite strikes; and four instruments for relaying temperatures. Mission responsibility for the satellite, which is designated S-30 by the National Aeronautics and Space Administration, lay with Goddard Space Flight Center.

A National Aeronautics and Space Administration contract for an orbiting astronomical observatory (OAO) is now being negotiated with Grumman Aircraft Engineering Corp. This model of the observatory proposed by Grumman shows side sections carrying solar cells, and cross-shaped radio aerials. The satellite is 9ft 6in tall and 6ft 6in in diameter and will weigh some 3,200lb (including 1,000lb of experimental equipment)

The South African Minister for the Interior, Mr Tom Naude, examines one of the metal objects which fell to Earth in the Transvaal Province in September. These pieces are believed to be parts of the US lunar probe launched on September 25 from Cape Canaveral. The initial opinion on one of the pieces returned to the US for identification was that it did form part of a lunar rocket

NUCLEAR ROCKET ACCELERATION

Proposals for research and development of a nuclear rocket engine have been requested jointly by the National Aeronautics and Space Administration and the US Atomic Energy Commission. The stage of carrying out a six-month preliminary design study has now been omitted.

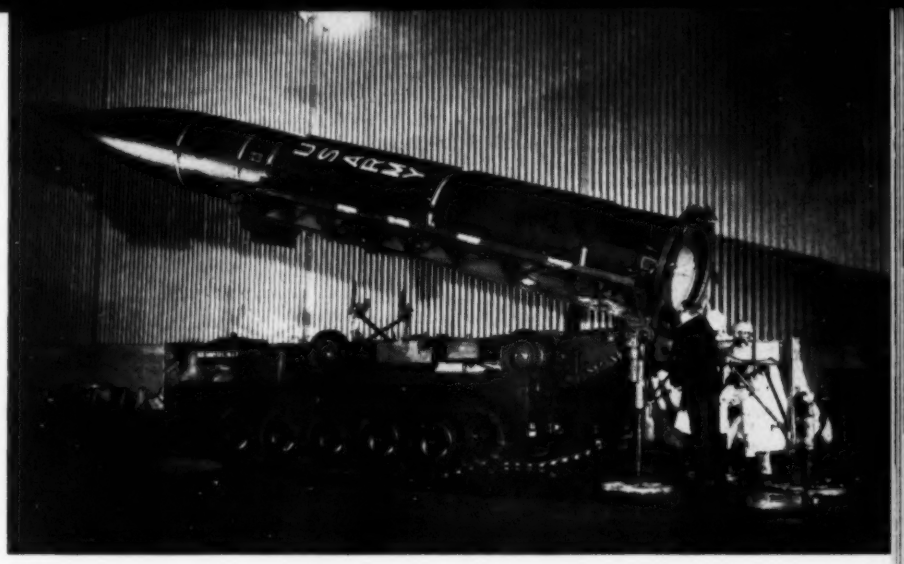
The US nuclear rocket propulsion programme, managed by the joint NASA-AEC Nuclear Propulsion Office and designated Project Rover, has included three nuclear reactors among the experiments completed to date. Most recent was the ground test of KIWI-A-3 by Los Alamos Scientific Laboratory at the AEC Nevada test site on October 19 last. This reactor used high-pressure hydrogen gas for its "propellant."

POLARIS BASE IN SCOTLAND

It was announced by the Prime Minister in the House of Commons on November 1 that the Government has agreed to make available a permanent sheltered base in the British Isles for the US Navy's Fleet Ballistic Missile Submarines. The base will be located in Holy Lock, on the Firth of Clyde some 30 miles west of Glasgow. The first FBMS depot ship USS *Proteus*, 18,500 tons, will arrive there next February, and a floating dock will be made available at a later date.

It is envisaged that eventually a squadron of nine FBM submarines will be based on Holy Lock, of which six will normally be on their eight-week operational patrol and up to three will be in port or on local exercises. Major repairs, modifications and replacement of reactor fuel will necessitate a return to the United States. Virtually all traffic in personnel, stores and equipment will be made by air through Prestwick. Up to 1,500 personnel will be in Holy Loch at any given time, and the permanent base staff will number 400 (excluding families).

In his original statement the Prime Minister made it clear



Taken outside Martin's Orlando plant, this striking night photograph is one of the first to show the US Army Pershing selective-range ballistic missile on its transporter/erector/launcher. As noted in our special "Missiles" issue last week, the latter is in turn mounted on an XM474 tracked vehicle to provide excellent cross-country performance. The launcher can be seen at the rear

Missiles and Spaceflight . . .

that any ship operating from Holy Loch would fire missiles only after the fullest possible consultation between the American and British Governments; the word "possible" appeared to have been omitted from the version of his speech which was published simultaneously in the United States.

LUNAR NAVIGATION

A one-day meeting devoted to *Navigation and the Early Exploration of the Moon* will be held jointly by the Institute of Navigation and the British Interplanetary Society on Friday, November 18. Non-members' registration fee for the meeting, which is to take place at the Royal Geographic Society (1 Kensington Gore, London SW7), is £1.

Papers are to be presented by Dr Samuel Herrick, University of California at Los Angeles; A. R. M. Noton, Nottingham University; D. J. Cashmore, English Electric Aviation; Dr G. R. Arthur, General Electric Co (USA); P. A. E. Stewart, Hawker Siddeley Aviation; and H. L. Bloom, General Electric Co (USA).

SAMOS IMPLICATIONS

A significant aspect of the American election campaign was that both political parties favoured a continuation of intelligence-gathering activities by the United States, and in particular (and in spite of the U-2 affair) by a reconnaissance satellite system of the Samos type. It now appears that the Samos project will be pushed forward with all possible haste, and it is reported that a back-up programme is being initiated for a second satellite designated the E-6.

The initial Soviet reaction to the firing of a successful Samos satellite will be most important. On recent indications, Russia will probably launch a massive propaganda attack against the United States. Almost certainly the issue of the U-2 flight will be raised again and will be linked with Samos.

The official United States distinction between the U-2 reconnaissance flights and the forthcoming Samos reconnaissance satellite flights rests on the legal distinction between aircraft and spacecraft. Although the 1944 Chicago Convention provided that each country should have "complete and exclusive jurisdiction over the air space above its territory," the question of the space above the air space can be regarded differently, on the basis of the absence of objections from any country over which the many satellites so far launched have passed.

The distinction is far from clear-cut, however, because of a number of factors including the absence of a definition for air space; the fact that Russia is not a signatory to the Chicago Convention and the United States has agreed only to a partial acceptance of its terms; and whether the acceptance of the "international" satellite orbits to date can be equated with general legal agreement on this as a point of international law.

A possible course of Russian action would be to denounce reconnaissance satellites on the grounds that they are military weapons. One indication of Soviet thinking was expressed by Y. Korobin—an eminent international aviation lawyer—in January 1959. While being careful to refrain from stating that the orbiting of a reconnaissance satellite would be an act of war, he did opine that such flights were at least evidence of mistrust of Russian intentions.

An often-mentioned possibility is that the United States will offer to operate the Samos under the general direction of the United Nations. It is difficult to imagine that Russia would ever agree to such a plan. She has nothing to gain from reconnaissance satellites, since all US military bases and a host of other Western targeting data are already known from various sources, including articles in the uncensored Western press.

On the other hand, the Soviet Union has zealously guarded all information of a military nature. Much information of military value could hence be gained by the West from the Samos vehicle. Perhaps, some have suggested, Samos could be a means of determining exactly what the Russian intentions are. Rather than being "evidence of mistrust," the Samos satellite might give the West the assurance that it seeks regarding Russian intentions.

If the Soviets do not agree with a step-by-step disarmament accompanied by appropriate inspection, there would appear to be no recourse but for the West to continue to maintain a substantial deterrent force. Use of the Samos, or some equivalent vehicle, could hence be regarded as *mandatory*.

Is the United States, therefore, to be condemned for her actions? Perhaps so, if she shrouds the Samos data in secrecy. Unilateral action is probably not the best way of quieting fears in the uncommitted nations that America is an aggressor. Should the USA accept this rather unfavourable role? The simple answer is no. If the United Nations cannot agree to operating a Samos-type vehicle, it would appear logical for the US to do the next best thing—which would be to donate freely to the UN, on a continuous basis, all the film records secured by the satellite. Russian, as well as American, intentions could then be freely determined.

DON ADAMS

Working on the first joint Anglo-American satellite at NASA's Goddard Space Flight Center, Greenbelt, Maryland, are (from the left) project manager Robert C. Baumann, project engineer Carl L. Wagner and project co-ordinator John T. Shea. On the table is the artist's impression of the satellite which was published exclusively in "Flight" three weeks ago

It is reported that the British Ambassador at The Hague has been informed that the Government of the Netherlands is interested in co-operating in the development of Blue Streak as a space booster, provided that a number of other nations also collaborate.

According to "informed sources" in New Delhi, the Indian Government is still examining the possibility of purchasing Bloodhound surface-to-air guided weapons and Sidewinder air-to-air missiles. The report claims that India wants a straightforward cash deal, but that delays are inevitable owing to limited foreign exchange and to the fact that the missiles are "not readily available for delivery."

Mr Walter T. Bonney, Director of Public Information of the National Aeronautics and Space Administration since its formation two years ago, and previously with NACA, takes up a new position on November 15 as director of public information of Aerospace Corporation, El Segundo, California. Aerospace is the non-profit company formed last June to assist the Ballistic Missile Division of the USAF in the forward planning and technical direction of its missile programmes.

The Epilogue of the Oklahoma Cow

By PHILIP WILLS

THIS article is in effect also an epilogue to the same author's "The Thermals of Texas," published in "Flight" for September 16 last and recounting his experiences in America's National Gliding Contest.

IT was really a calf which produced the epilogue to this flight, possibly assisted by a pony, but I don't want my title to be ambiguous. Although a lot of people try to hide it, the fact is that most sailplane pilots (myself among them) really adore nothing so much as a good old vulgar down-wind dash on a corking day. This gives the maximum amount of trouble to everyone, including the pilot, but particularly the retrieving crews, and the organizers don't like it much because it means Operations has to stay up all night waiting for landing reports, and a blank rest day the next day whilst everyone struggles back. So, as I say, a lot of people pretend they are superior to the siren call of Free Distance, but I suspect that few are without the hunger.

Certainly at every morning briefing in the 1960 US Nationals at Odessa, Texas, we eagerly awaited the announcement of this task, and there was mounting disappointment as it was delayed. For the weather situation meant that time was not on our side. The weather at Odessa itself, and for 200 miles around, never altered—strong thermal and cumulus streets building up each morning from 11 a.m. onwards, dying between 6 and 7 p.m.; but further north a giant front looped across the United States like a 2,000-mile girdle across the stomach of a wide woman, and this moved slowly south, eventually reaching Odessa and blanking out the thermals with clouds and thunderstorms on the ninth day.

Now our winds every day blew at the surface from the south-east at 20-24 knots, and above 5,000ft (8,000ft a.s.l.) from the south-west at 10-15kt; thus a down-wind dash took one up to the approaching front, as one got nearer the winds veered or backed so one could turn and parallel the front either way. The sketch-map on the opposite page shows how.

In these circumstances either Friday, August 5, or Saturday the 6th would have been good days for Free Distance, but our task-setters were overburdened by a promise to our sponsors, who had required an air display on the 7th, so finally the big day was announced at briefing on Monday, the 8th. By this time the front was barely 200 miles north, and the decision to be made was whether to attempt a cross-wind flight into the lee of the mountains to the north-west in New Mexico (where the upper winds were westerly), into a region of subsiding air and dry thermals, or towards Oklahoma in the north-east, where conditions looked better but the cross-wind component on the way was much worse. After much agonizing thought I and most of the leaders chose north-east, but in the event it made little difference, as both contingents made almost the same distance.

By now the days already flown had made it clear that on short tasks simply involving three hours or so flying across the best of the day, the Skylark could not be expected to keep up with the leading flying bombs, designed exactly for this comparatively narrow spectrum of conditions; whereas on long tasks, using everything the day had to offer, my ability to start earlier and finish later than them gave her a better chance, so this was in another sense a Big Day for me. By now Dick Schreder in his HP8 had piled up a maximum score of 5,000 points in the five tasks we had flown, and I was lying fifth, with an annoying Kas (slightly cleaned up) piloted by Kit Drew just on my toes in fourth place.

The first small cu could be expected exactly at 1100hr, the heavy stuff to take off about 1130, so I put myself down for 1045, planning to hold the air on dry thermals for the first quarter of an hour. In the blinding hot blue heat we dragged our way to the head of the line. I was packed in in my shirt and shorts, my hat on my head over a small wet towel (a very useful and refreshing way to keep one's senses in these conditions); another wet towel (whipped off at the last minute) over the Perspex cockpit canopy; a bottle of drink, also wrapped in a wet towel; my maps, food, pen and ruler in the canopy pocket; both barographs installed, sealed and ticking; oxygen on; my devoted and perspiring crew buzzing around, running out the tow-rope, last-minute polishing of wings and canopy, holding the wing-tip, flagging the tow-plane, running, letting go—we were off.

Wheels dropped, we left the runway and the flat and chequered brown landscape of Texas opened up and widened to the ever-expanding dusty horizon all around. We climbed in a wide left-handed circle which brought us round over the runway again at 2,000ft, the tug wagged its wings, and I released and turned right. Looking round, I saw that a few of the earlier starters had struggled off downwind in a northerly direction and were now circling in a small bunch low down about three miles away. I wanted neither their direction nor their altitude, so forged ahead towards the town of Odessa itself to try for lift off its roofs, which I duly found. I held this without much difficulty for a quarter of an hour, being joined by a contingent who were also clearly destined for Oklahoma, when dead on time the first barely visible puffs of cu started to form in the sky around and above.

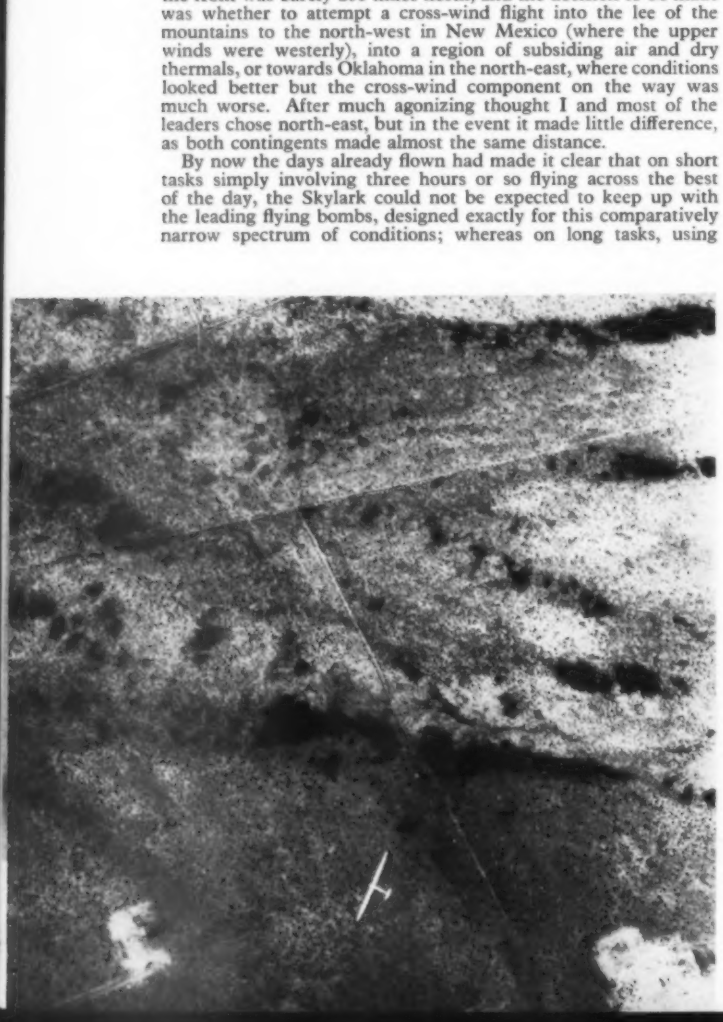
With Sinking Heart

The upper wind was much stronger than forecast, and retained the south-easterly direction of the surface, so it was with a sinking heart that I set off across and slightly into it to the north-east. In a wild way I had declared a goal at McAlester, 425 miles to the ENE, as near the line of the advancing front as I dare go, but I had warned my crew that I might have to fly north of the track to begin with, and this became clearly a must.

The lift was still only around 250ft/min, but the game was on, and I struck off at 55kt, for the shadowy hint of high white steam some five miles over the mesquite bush to the north-east, followed closely by three or four other aircraft. Within half an hour the sky had developed into the usual Texan elysium of dappled cu based at 5,000ft above the surface, their shadows below racing across the ground—alas, at right angles to my course. There was no hope of holding my track; furthermore, I was finding unexpected difficulty in striking the lift areas, coming in as I was from the side of each upcurrent, and suddenly I missed one altogether. Before I knew where I was I was down to 800ft, one hour and 20 miles from base, in a sky looking like silent dynamite.

Only sailplane pilots will feel my agony—was this to be the end of my Big Day? No thoughts now of speed or holding my track. I struggled round and round in plus or minus 100ft/min over the inhospitable ground, not daring to go further afield. I knew that almost certainly in one direction or other I could find strong lift if I could reach the heart of the thermal in whose edge I was clearly confined, but if I took the wrong one I would be certainly swept in the strong surrounding down-current to an ignominious—and possibly expensive—landing.

In such a circumstance a sailplane pilot seems to run out of eyes. All one's attention is needed for the instruments, yet some has to be spared for the ground below and some for the sky above, and suddenly in the latter I saw my salvation. A soaring hawk on rigid outstretched wings came into my line of vision from the south. Clearly he had been in my thermal, and on seeing this Brobdingnagian brother circling in the distance he had assumed that my wisdom was in proportion to my size, and had come over to see if I had found a better bit than he had. He did a couple of circles just over my head, and I could almost see his



". . . round and round in plus or minus 100ft/min over the inhospitable ground, not daring to go further afield"

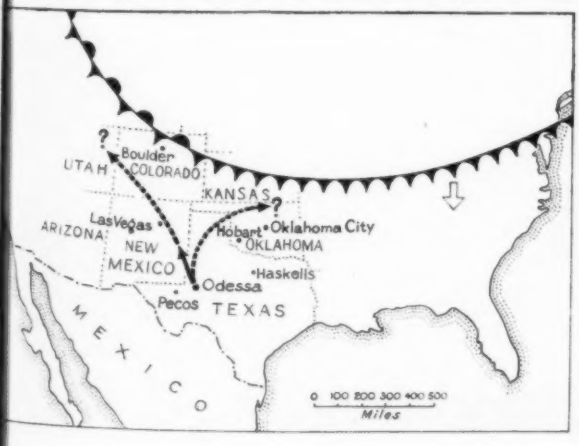
"The road ran as straight as a ruler . . . from horizon to horizon"

beak curl into a contemptuous sneer as he tasted the miserable rags of my lift; then he turned and glided straight back the way he had come.

No thought of saving the face of my theoretically superior species prevailed on me to hesitate. I straightened up and followed my feathered friend and in two minutes was circling up at 500ft/min to cloudbase and competition again. I was once more in the running, but sadly off course and with perhaps half an hour of distance lost. Lamesa was just to the north of me, and since distance was the order of the day irrespective of direction, I must now clearly reduce my attack on the wind and alter course as far north as I dare. Poor crew, struggling away to the east? If I had had radio, I am not sure that at this moment I would not have called them and set off for New Mexico, but the prospect of my landing point finishing up around 800 miles from them that evening was too daunting, so I carried on.

Twenty miles covered in the first hour was followed by 42 miles in the second, and south-east of Lubbock I came over a wide stretch of wet irrigated land, with large round muddy ponds in every field, which I had been warned might be a trap. But no, all went well, and soon I flew over a line of low hills, and for 50 miles or more a stretch of wild bush-covered country cut into by a series of jagged sandy dry river-beds, which the thermals alone made safe for me. Then we approached and crossed a larger river which (having clearly been discovered by some devotee of TV Western) goes by the name of Prairie Dog Town Fork, and the country below became greener and kinder. We were in Oklahoma, the ground had imperceptibly receded to only 1,500ft a.s.l., the time was 1700hr, our average speed was only 40 m.p.h. The wind had almost dropped and the day was starting to die. But there was still no sign of the dreaded front to the north.

Out of the haze to the north-east appeared a few high granite outcrops—the first sign of hills we had seen in three weeks, and south of them the last cumulus in the dying sky lured me over the town of Altus. There I climbed gently to 7,000ft and set off on my final glide. I was now off my original map, so the exact direction to fly away from Odessa as far as I could was rather a guess; but I set off north-east, scanning my map for suitable airfields, and at last it seemed as if one on the south-east of the small town of Hobart might just about come up and meet my skid. But as I got lower I entered a strong southerly wind, and this carried me further than my chart had led me to expect, so that I reached this airfield at 1,500ft. A comfortable and safe landing, or another nine miles to an uncertain one?



But this was exactly the advantage I had over the heavy boys, who needed much more in the way of large landing areas than I did; so, fatigue after nearly eight hours in the cockpit notwithstanding, I flew on along a main road running north, lower over fields of cotton, maize, corn and fallow, until the time had come. At 400ft I turned into wind and landed in a large soft ploughed field running up to the outbuildings of an impoverished looking single-storey wooden farmhouse standing amongst a few trees by the side of the main road.

It was after 7 p.m. and I had been over eight hours in the air; I climbed rather stiffly out of my cockpit onto the soft and sandy plough, with a few old maize stalks sticking out of it. A warm breeze from the south, and a smell of earth and green growing things, again brought back that feeling known to all sailplane pilots—that the workaday world had once more taken over, and that much organizing and sweat lay ahead before my team could arrive and bear me and the Skylark back to base. A couple of young men in jeans climbed over the fence ahead of me and came ploughing through the soft earth. There are not many sailplanes in Oklahoma and none had ever been seen in these parts, let alone one inhabited by an Englishman speaking a strange and nearly incomprehensible dialect; but in due course I got my needs across—a telephone, and then help in derigging the Skylark and carrying the parts out of the field to the borders of the road before the onset of darkness.

Farmhouse Welcome

Eventually, however, it was done. I had phoned Odessa and asked that Kitty, when she got my message, should ring me and say where the crew had got to; the wingtips and tailplane were stowed on the lawn in front of the farmhouse, on the very edge of the road. The heavier fuselage and centre-section, however, had us so exhausted by the time we had carried them over a quarter of a mile each through the soft earth and up a bank that, at the farmer's suggestion, we had left them in a small empty enclosed yard at the back of the farm, with a track to the road which the trailer, when it arrived, could easily negotiate. We went back indoors; and, with typical hospitality I was sat down with the family at a simple but enormous farmhouse meal—before which, as the visitor, I was bidden to say Grace.

After this, the farmer, his son-in-law and I sat smoking on the verandah whilst the womenfolk washed up (no use asking to help in this chore on an American farm) and put the children to bed, and we chatted on into the gathering darkness, lit by a naked electric bulb, of farm prices, horses, the ways of rattlesnakes, the price of things in England as against Oklahoma, and all the things that come up at these casual and unexpected meetings of people from different worlds. Kitty had phoned: the team were 160 miles south of me, so they could be expected to arrive between midnight and 1 a.m. I could not wish to keep my host up so late, and around 11 o'clock he asked if I would like to lie down for an hour's nap. I gladly agreed, said I would get up and wait by the roadside at midnight, and promised not to wake anyone when the trailer arrived, but pack up and steal silently away.

Shown to the spare bedroom back of the house, I washed some of the sticky dust off my face and hands, thanked my host for all his kindness and, as I dozed off, heard his son-in-law go out into the yard at the back and return to the house, which sank into silence except for the occasional ping of a prowling mosquito in the warm darkness around me. At midnight I got up, tiptoed out of the sleeping house, and sat down on the dry grassy verge.

The road ran as straight as a ruler right and left from horizon to horizon. The moon was nearly full and riding high, and opposite me was etched the rounding and rustling outline of a large tree from which shrilled the stridulation of a thousand crickets. From the farmhouse behind me came the occasional mutter of a half-awakening child. Time passed on and I thought of many things. I thought how fortunate I was in this extraordinary sport of ours to have seen so many lands and scenes and met so many kind people. Of how, two years before, I had been faced with a similar but more uncertain wait in the Marshes in Poland; then, as now, Kitty had been thundering through the night to my aid, then with Ray and Harry, now with Gale and Bob. I thought of my various sailplanes, and where they were, the Scud still in England, a little anonymous now after more than 25 years, Hjordis a wreck in a hangar at Germiston near Johannesburg, the Minimoa in

". . . thus a down-wind dash took one up to the approaching front, and as one got nearer the wind veered or backed so one could turn and parallel the front either way"

The Epilogue of the Oklahoma Cow . . .

Iceland, the Weihe in New Zealand, my victorious Sky in Holland, and now my dear Skylark sitting in a field in Oklahoma bound for its new owner in Boulder, Colorado.

The surface wind still blew lightly from the south, but a light haze of high cloud was drifting from the north, and the moon was going out of focus. The horizon was lit up by the headlights of an approaching car, but it was a good ten minutes before it reached me—and swept trailer-less by, and on and over the reciprocal skyline.

I mused on, on love, on hope and on despair. Looking at the fading stars I thought on the universe, and touched on the greatest question of all: What in Heaven's name is it all about? The crickets chirped louder than ever; they knew as much about the answer as I.

The haze had thickened, a ragged cloud drifted across the moon, and a distant flash of lightning and mutter of thunder to the north showed that the front was on the march again, and coming my way. My mind touched on bills of exchange, the Bank Rate and four per cent Consols; and by alliteration on my home at Kits Close, on Kruschev, on Christmas crackers. . . .

A few drops of rain brought me round with a snap, and a glow of light to my right brought me to my feet. It was after 1 a.m. and this *must* be the trailer. It was. Ten minutes later, still cheerful after their 500-mile drive, and facing over 400 miles on the homeward run, my team drew up beside me. Quickly I explained the form, we put the wingtips and tailplane into the trailer, then turned up beside the farm onto the track to the yard behind. As I laboriously undid the wire gate leading into it, the storm broke. A violent northerly wind brought with it a blinding cloud of dust, and as we drove into the yard and tried to unhitch we found it difficult to weathercock the trailer into the wind, and get her hoisted onto her legs.

Then I led the way to the white fuselage looming on the ground —and as we got near I heard a cry of horror from Kitty. At the base of the rudder yawned a horrid jagged hole, and the ply in the fin was gashed. Another shout from Gale, leaning in the streaming dust over the centre section, signalled a staring ragged panel in the fabric near one tip. I stood stupidly gaping. This was *impossible*—in an empty yard? When I had explained so carefully, as is my wont, how delicately the Skylark must be handled on the ground. But now came more shouts and scuffles in the darkness and gritting wind, and round the corner of the trailer, in the light of Kitty's torch, came the flying shapes of a small calf and a pony, racing for the open gate behind me and freedom.

Instinctively I shot ahead of them and closed it—I could not repay my host's kindness by letting the beasts loose, whatever they had done. But there was no more to be said. For some reason for ever unexplained, the son-in-law, when he went out after I had laid down, must have turned these two frisky animals into the yard where we had put the Skylark; then he must have retired to bed. Sadly we locked up our wounded craft, sadly we stole out onto the wind-swept road, sadly we drove away into the night, drove until the sky brightened, the sun rose again, the day's heat returned. Alternately we drove and slept in the back, and about 11 a.m., exactly twenty-four hours and more than 900 miles after we had left it, my crew and I were back in Odessa.

How we needed sleep! But we were inexorably driven by the necessity to repair the ravages of the night on the Skylark. In this Gale took the major brunt with willing help from others, since this is a field in which I am woefully deficient. Apart from the damage we had seen, the paint was rasped by tongue and teeth, since dope has a taste irresistible to cattle, but on the whole we were lucky. The next day the front had caught us up and there was no flying, so by the following and final day I was once more in the air, and put up a reasonable flight.

As for The Day, on the whole it had been worthwhile, for this was the only day in which the HP8 lost first place, the RJ5 being ahead of me by ten miles, and the Skylark, with a distance of 298 miles, clocking an honourable second place, by virtue of my extra hard-won nine miles, and ascending to fourth place in the Championships, which it held to the end.

But for the Oklahoma cow it would have been quite a triumph. And now I was left with a serious social problem. I had promised to write a letter to my host of the night on my return to England. What was I to say?

FIRE-FIGHTING BY TURBOJET

AN ingenious method of introducing large quantities of inert gas to serve as a suppressant in fighting fires was demonstrated at the new buildings of the Fire Research Station, Boreham Wood, Herts, when they were opened by Lord Hailsham, Minister for Science, on November 4.

Among the many fire-fighting problems which the Joint Fire Research Organization of the Department of Scientific and Industrial Research and the Fire Offices Committee has been studying at the Fire Research Station is that of tackling a fire in a building where smoke and flames prevent access to the seat of the fire. An example was the Smithfield conflagration of December 1957, when the firemen were faced with the formidable problem of trying to reach the fire through a warren of smoke-filled underground corridors. Now, with the collaboration of the National Gas Turbine Establishment, the Fire Research Station has evolved a method of introducing large volumes of inert gas to a fire by means of an aircraft turbojet engine. A Bristol Siddeley Viper with reheat was modified as a gas generator for the purpose, by fitting in the tail-pipe a series of transverse tubes with perforations through which water is injected in a fine spray into the efflux.

The reheat has the effect of reducing the oxygen content of the efflux by vaporizing the water, thus providing a large volume of steam which further dilutes the ejected gases. When the reaction has reached its maximum value the oxygen content is reduced from the normal atmosphere proportion of about 21 per cent to only about 7 per cent. The percentage composition of the efflux under optimum conditions is: water vapour, 45; nitrogen, 45; oxygen, 6; carbon dioxide, 4. This is ejected at up to 50,000 cu ft/min.

The generator is mounted on a three-ton lorry equipped with the necessary fuel tankage (fuel is burnt at 6gal/min and water vaporized at 65gal/min) and control equipment. A branch pipe from the tailpipe vents the efflux upwards during the 3-4min run-up period, and is then closed by a valve. Under operational conditions the gas (which leaves the tailpipe at 100°C) would be led into the burning building by large-diameter flexible ducting.

During a visit to the Fire Research Station prior to the official opening *Flight* was able to see the generator running. The efflux was a roaring torrent of steam, but it was stated that in practice the heat of the fire would prevent condensation and render the gas transparent, thus permitting firemen wearing breathing apparatus to see their way into the burning building. The extinguishing of a burning torch in the outer edges of the gas stream—not in the main stream, where the flames would have been simply blown out —was demonstrated. The DSIR emphasizes that the equipment is still in its early stages but that prospects are "promising."

During our visit the station demonstrated other aspects of its work, among which is the study of fire-extinguishing media. One test seen was that to determine the so-called "critical thickness" of foam used against petrol fires. While a stiff foam will efficiently seal a burning liquid surface with a thinner layer than do the more fluid foams it is more difficult to get it to spread quickly over the surface. Current experiments seek to determine the best methods of applying foam of the most efficient consistency. It is understood that the wide-cut gasoline v. kerosine fire problem is one now forming the subject of an investigation in conjunction with the ARB and other organizations.

The turbojet fire appliance being demonstrated at Boreham Wood. The man on the right is holding a rod carrying a piece of burning, petrol-soaked cotton-waste, which was immediately extinguished

"Flight" photograph

Unloading betel leaf at Lahore, one of the two western terminals of the service between East and West Pakistan, is a PIA L.1049C

PIA Profile

Part 3—East Wing, West Wing

BY ALASTAIR PUGH

HERE is the final instalment of a series of articles by a "Flight" staff member who has recently been visiting Pakistan International Airlines. It deals with problems and prospects of the airline's regional and domestic routes.

THIS has been an appropriate time to look at some aspects of PIA's operations for, after a long struggle, under its new management the airline last year broke through into profitable operation.

The route structure on which the majority of the airline's traffic is carried is a domestic one in Pakistan and regional services to India. These comprise the Super Constellation route between East and West Pakistan, a network of Viscount services in the West, DC-3 services in each wing, Viscount services to Delhi and Bombay, and DC-3 services to Calcutta. There is also the Kashmir freight charter described in *Flight* of October 28.

Operation of a Boeing 707 on PIA's international route has tended this year to overshadow the airline's important function as a low-cost domestic operator. Nowhere is the public-service aspect of PIA better illustrated than on the service which unites West with East Pakistan. The low-revenue-rate character of this service, on which PIA provides the sole link over the 1,400 miles separating the two wings of the country, typifies the whole domestic operation. Elsewhere domestic revenue rates are lower still, reaching a minimum of about 4d. per passenger mile.

In spite of a steady decline in cost level these rates are such that PIA must achieve high load factors to break even on domestic services. Broadly speaking, domestic operations require a theoretical 500 mile stage to break even at an average load factor of 85 per cent, and a 650-mile stage to break even at an average 75 per cent load. At an overall load factor of 65 per cent the average revenue rate is insufficient to balance present costs and the break-even point cannot be reached.

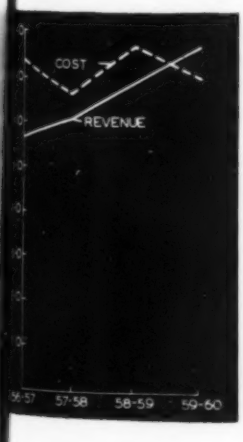
It is perhaps not surprising that the airline should place emphasis on building up the international route on which revenue rates are so much greater. The effect of increasing international capacity in relation to that carried on domestic and regional services can be seen in the graph below of average revenue rates per passenger mile. This shows quite clearly how profitable operation has been associated with an average revenue rate rising as international services increase. Whereas in 1959 domestic and regional operations accounted for two-and-a-half times the capacity ton-miles offered on overseas services, the proportion is now nearer 60-40. Allied to some big increases in traffic on international and regional services average monthly revenue has risen from £325,000 in 1958 to £550,000 today. By the end of the current financial year it should be more than double the 1958 figure and the airline—which until 1959 operated at a loss—should this year increase its profit to over £½m.

The most satisfactory domestic route from an operating viewpoint is the service from Karachi and Lahore in the west wing to Dacca in the east. Not only is this an unusually long sector for a domestic service but the airline gains also from subsidized tourist fares. PIA are careful to point out that this is not a subsidy to the airline, but to the passenger, who pays only 200 rupees out of the full fare of Rs385, the difference being made up by the Government. This subsidized low fare is available to passengers of any nationality but applies to tourist-class tickets only. With 20 Super Constellation services a week being operated between the east and west wings this route accounts for 50 per cent of all PIA's revenues. Although load factors run consistently high there has for a long time been an excess of capacity available for this and other domestic services. The problem is aggravated by the withdrawal of Super Constellations from the international service to London. While this will enable frequencies between East and West Pakistan to be increased, it is to carriage of freight that the airline's management are looking to increase Super Constellation utilization beyond last year's average of 7.15hr per day.

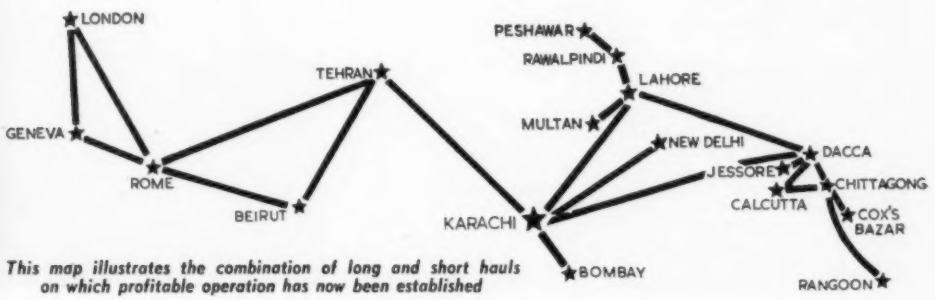
Because PIA lack freight experience they have employed the Pakistan Business Research Centre to conduct a study on their behalf. In particular the centre will investigate the commodities that will respond best to five hours' travel by air between east and west against the three days it takes by rail across India. Freight rates are shortly to be put on a more logical commodity basis, and may eventually be sharply reduced.

Since two of the airline's Super Constellations are L.1049Hs (the remainder are L.1049Cs) the nucleus of a cross-continent freighter fleet already exists. If the freight market can be developed as the passenger aircraft become fully depreciated they will probably be converted to all-freight configuration and continue in PIA service when a new passenger aircraft is on the east-west route.

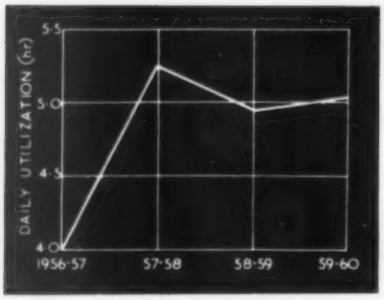
Regular travellers are already looking forward to a Constellation-replacement. Because of cylinder head limitations resulting in a restriction on the use of high blower, the Connies operate between 10,000 and 12,000ft, and although they are equipped with weather



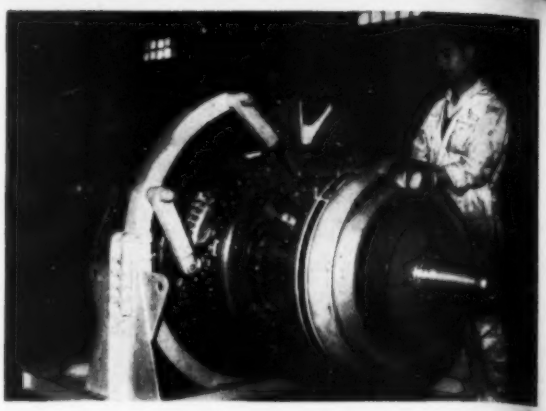
(Left) Course into profitability. The factors behind PIA's fall in costs and increase in revenue rates are discussed in this article



This map illustrates the combination of long and short hauls on which profitable operation has now been established



(Left) The growth of fleet utilization



(Right) All Dart RDa.7 maintenance is carried out by PIA at Karachi

PIA Profile . . .

radar, this restriction can lead to some uncomfortable flying in monsoon weather.

It is one of the paradoxes of a country so relatively poor as Pakistan that there should be this clamour for more modern aircraft in which to travel. In East Pakistan there has this year been a noticeable slackening in the growth of DC-3 services from Dacca east to Cox's Bazar and Chittagong and south on the regional service to Calcutta. This is all the more surprising in a country where overland communications are as poor as those around the Ganges Delta. It is not in any way associated with PIA's operational regularity, which has been quite satisfactory, but only with the feeling that DC-3s have been operating for a long time and must therefore be growing both old and dangerous. It is on these services that PIA will at the end of this year be introducing Fokker Friendships; they are confident that turbo-prop services here will do as much to stimulate traffic as introduction of the Viscount has done in West Pakistan.

After a dismal start (two of PIA's five Viscount 815s were lost in the early months of service) the Viscount operation this year has settled down to an enviable pattern of regularity. In February, March and April this year there was not one technical delay, and between June, July and August only 13 delays occurred from all causes in 326 services. This was despite the fact that July and August are monsoon months.

In other respects, however, the Viscount operation is not an easy one, route density being very low (for comparison about one-third of the BEA average) and revenue rates substantially less than those general in Europe.

It is also broadly true that Viscount load factors are too high while the aircraft, at an average 5.31hr per day, are under-utilized. The reason for this is the limitation from which PIA has suffered in the past on domestic operations at night. Starting this autumn frequency will be increased by working Lahore and Rawalpindi at night. Approach lighting is to be installed and both these stations are to operate on a 24hr basis.

The past year has been characterized by the new management's drive for greater utilization and increased efficiency in every branch of the airline's service. Some notable success has been achieved on Viscount turn-round and on baggage handling. The 45min turn-round common a year ago has recently been reduced to 20min, and a 15min turn-round is now a current aim.

A peculiar national problem is that for every passenger departing by a PIA service there are three friends to see him off. While this hampers the work of airfield staff, some useful strides have been made in ticketing procedures and in the work of airport-counter staff. Disembarking at Karachi after a Viscount flight from Lahore the author was able to collect his baggage and be in a taxi exactly eight minutes after leaving the aircraft. Although this is not an isolated example of good handling, ways of improving service are still being sought. Counter space is in general very restricted while the airline still suffers from a shortage of adequately trained ground personnel.

Standards of cabin service are another aspect of the domestic operation in which a genuinely close interest is taken. During the latter stages of every flight each passenger is presented with a sealable comment form for return to the managing director. Every one of these forms—several hundred a week—is in fact read by Air Cdre Nur Khan, and every case of dissatisfaction is answered with a letter over his signature.

Another way in which the airline have sought to improve their efficiency is by instituting a daily operational control briefing, again presided over whenever possible by the managing director. This briefing, which starts the day at PIA headquarters, is attended by the staff in charge of the operational control unit, flight despatchers, and by the chief engineer. It gives the airline's senior management an opportunity to examine the day-to-day regularity of each service, to ascertain the causes of delay and together to plan charter and other non-scheduled flights.

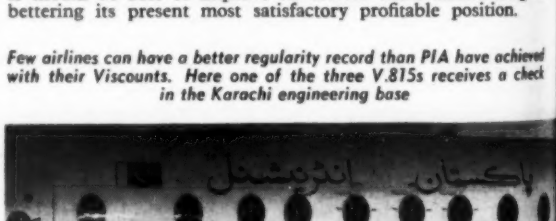
Apart from the Boeing operation, PIA are completely responsible for maintenance and overhaul of the airframes, engines, instruments and electronics of all aircraft in the fleet. A cause of particular satisfaction is that the maintenance and inspection facilities at Karachi have recently been approved by the FAA as a repair station for foreign-registered aircraft. This approval, it is said, has been given to only 16 non-US airlines. Although the throughput of work is still relatively low, and overheads are thus rather high, it is important to an airline in PIA's geographical position to have responsibility for overhaul under its own wing. Considerable outlay on tooling and the installation of test cells for Darts and Wright turbo-compounds has resulted in the airline achieving overhaul lives for these engines of 1,800hr and 1,450hr respectively. A fair measure of maintenance performance is the number of premature removals per thousand engine hours. At 0.669 for the L.1049 and 0.271 for the Viscount those achieved by PIA are a good average among those of other airlines. Premature engine removals on PIA's DC-3s—0.71 per thousand hours—are believed to be rather better than the general average.

Disadvantages under which PIA operates are short-haul routes in East Pakistan, low density routes both in East and West, uneconomical utilization of aircraft and a low domestic revenue rate. On the other hand, labour costs are low, and although by the usual measure of productive efficiency of staff—the capacity ton-miles performed per employee—PIA's results are poor, cost of production in relation to salary per employee is also low. Put another way, PIA gets greater production from each pound spent on salaries than does, say, BEA. Another advantage is that the route structure contains usefully productive sectors: the international routes and the long haul between East and West Pakistan. The higher-than-average tariffs on these routes help to offset the poor economics of short haul services.

Big strides have been taken this year in tightening up administrative and operational discipline, in giving additional general and refresher training to pilots, and in the exercise of closer control on all aspects of the airline's operation. If PIA can capitalize on the air freight potential between east and west, argue the case for better airport facilities and increase Viscount utilization by encouraging travellers to use night services, much would be done to improve the weaknesses of the present position. A resurgence of traffic in East Pakistan should also improve the economy.

If, in addition, by continued training and the impetus of its enthusiastic management, PIA can increase its relative output while holding down cost of production to near the present level, it should be able to improve its service while maintaining or bettering its present most satisfactory profitable position.

Few airlines can have a better regularity record than PIA have achieved with their Viscounts. Here one of the three V.815s receives a check in the Karachi engineering base



Two of the Westland Wessex of 700H Flight over the Cornish coast. The square white outlines on the spine of the aircraft mark safe footholds

Proving the Wessex

Westland's Turbine-powered Helicopter in the Anti-submarine Role

"Flight" photographs

SINCE the end of March this year the sight of Wessex helicopters has become a familiar one at RNAS Culdrose, near Helston in Cornwall. They made a public appearance there when the station was "at home" on July 15, in a troop-carrying capacity; but the main work of 700H Sqn Wessex Flight is evaluating the aircraft in an anti-submarine search and strike role, and *Flight* recently went to see how this was proceeding.

The task of the unit has been broadly defined by its commanding officer, Lt Cdr R. Turpin, when he commented: "We are learning a great deal about the aircraft from the flying and maintenance aspects. We are subjecting them to a very intensive flying programme at maximum all-up weight, never having a serviceable aircraft on the ground during airfield opening hours." The original conception of 700H Sqn Wessex Flight was that it should have eight pilots, four observers, and four underwater control crewmen. Equipment was to comprise six aircraft. In its squadron role as an AS aircraft, the Wessex is to carry two pilots, one observer and one underwater control crewman. The first squadron is to be formed next year, but no date has yet been announced.

At the time of *Flight*'s visit, the unit had nine pilots and six observers. The crewmen are not fully in the picture as 700H have not yet received aircraft with the 1N anti-submarine system, but they are assisting with the recording of in-flight information. Lt Cdr Turpin is already conversant with 1N techniques. On exchange posting in the United States, he flew S-58s and helped to develop a training programme on the system. He was formerly the Duke of Edinburgh's personal helicopter pilot.

The Senior Pilot, Lt Cdr G. A. Bagnall, has been a flying instructor on both fixed- and rotating-wing aircraft and did a tour of the West Indies with a Dragonfly on HMS *Vidal*. Lt Cdr D. Elliott is only with the squadron temporarily and is going to be a Wessex flight simulator instructor; Lt Cdr J. A. Neilson, nsc, is an ETPS graduate who came into helicopter flying after he had had an accident in a Sea Vixen on tropical trials near Tripoli, Libya; Lt B. G. Sirett was on a Gannet anti-submarine squadron and only recently re-familiarized on helicopters—shortly before our visit, he had carried out a successful forced landing in a Wessex in a field near Culdrose airfield; Lt M. J. Fournel has done nearly all his flying on helicopters including carrying out trials of the P.531 on the frigate *Undaunted*, when night landings were made: he has also been on minesweeping trials, has done a lot of ASR work and was on the Naval helicopter squadron in Malaya; Lt D. J. Woodhead, who got his wings within the last four or five years, has been on two front-line anti-submarine squadrons and when *Flight* when to Culdrose was due to go to the Central Flying School as a helicopter instructor; Lt D. G. M. Fraser, a Canadian in the Royal Canadian Navy is serving in the United Kingdom on an exchange posting; and Lt J. G. C. Williams, an engineer officer who has done a pilot's course, has gained experience of commando carrier operations with No 848 Sqn. Since *Flight's* visit, 700H has received two more pilots: Lt Cdr R. A. Miller, USN, an American who has served on a Royal Navy helicopter squadron; and Lt N. K. L. Whitwam, who trained in the US and has had both fixed-wing and helicopter operational experience.

The 700H observers are Lt R. J. Bates, the Senior Observer, who is well informed on anti-submarine equipment and how to operate it and has helped to plan the combating of submarines in maritime exercises; Lt B. J. Munday, an experienced observer who is "somewhat of an expert in the development of tactical computers"; Lt G. De S. Atkin, who is leaving 700H at the end of this year to take a helicopter pilot's course; Lt J. R. Humphries who is due to do an ATC course; Lt P. M. Dullingham (ex-824 Sqn) and Lt M. A. Palmer (ex-820).

The engineer officer of 700H Flight is Lt Cdr Graham Smith, who has previously had experience of Whirlwind Mk 7s; and the electrical officer is Lt Cdr Leslie Nuttall, who is assisted by Sub Lt "Nobby" Hall. There are about 85 ratings on the Flight.

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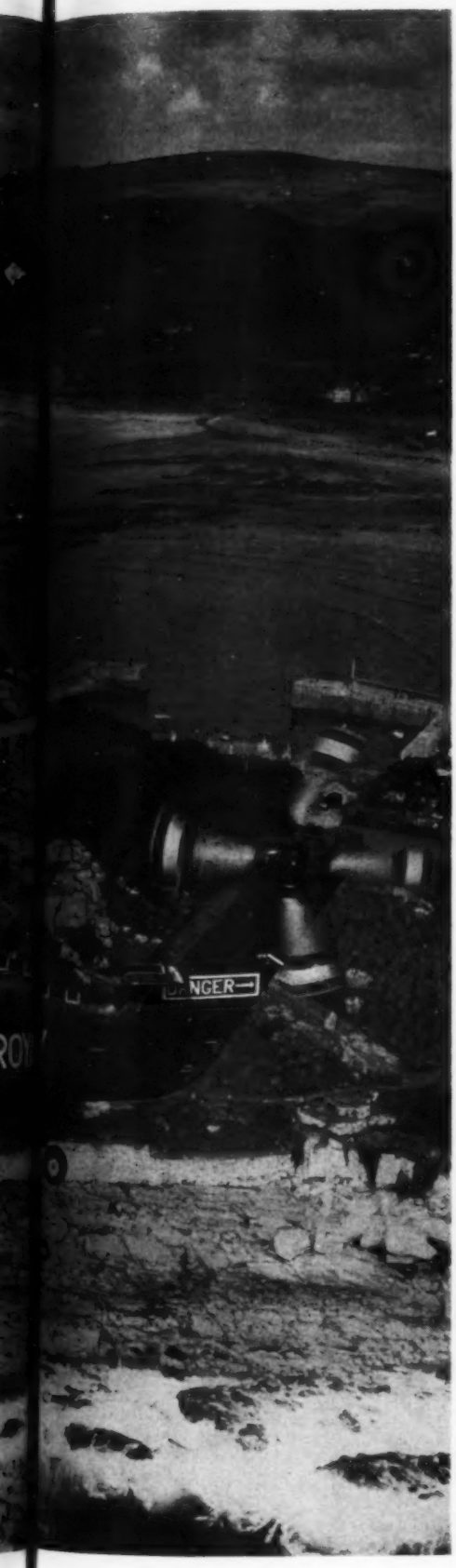


Proving the Wessex . . .

700H Flight originally received two aircraft, XM832 and XM833, then early in October received a third Wessex, XM834. At the time of *Flight's* visit this had done 75hr flying and was due for its first engine change. (Engine life has since been extended.) The Wessex helicopters being evaluated fly at a gross weight of 12,500lb at first take-off. At this load, they have a rate of climb of approximately 2,000ft/min. When they are flown with only two crew members (the pilots), compensatory weights are carried in the rear of the fuselage. It has been found on 2¼hr details that the aircraft are landing with 400lb fuel, indicating that they have enough for up to three hours' flying. One of the chief tests is that of hovering, and about a dozen exercises have been evolved in which the aircraft do a percentage of hovering and a percentage of forward flying. They fly as from a ship, "jump" to a strategic position, hover, make simulated contacts, hover for 50min longer, then return to the ship. Such a sortie involves 60 per cent hovering, 40 per cent high-speed cruising.

The Wessex with its Napier Gazelle N.Ga.13 is the first British helicopter to have a gas turbine engine. The aircraft carries UHF and HF radio, "dunking" Sonar, radio altimeter and Ryan APN-97A Doppler. Its anti-submarine weapons are carried externally and the 1N system which is being fitted is licence-manufactured in this country by Louis Newmark Ltd.

In *Flight's* description of the SBAC Exhibition (issue of September 16) the following reference was made to the 1N system: "Newmark Aircraft Division have evidently been working for some time to anglicize a Lear automatic anti-submarine control system for helicopters called the Mk 19 autopilot. It probably applies to the Wessex and incorporates very comprehensive facilities for automatic hovering, (a) stationary with reference to a ground or water surface with the aid of Doppler, (b) stationary in space by short-term inertial reference, (c) vertically over a suspended buoy which may be drifting in a tidal current. . . . Barometric height lock is provided for normal conditions, but radio altimeter, Doppler height measurement or a pendant cable may be used for precise height control. Standby remote-gyro attitude indication is provided and any of the four control axes may be individually switched off."

At present, the Newmark autostabilizing unit for the 1N system is only fitted in one aircraft (XM834) at Culdrose; the first Wessex with the complete system is due to be received in January next year.

The work of 700H Flight involves three phases of evaluation —the engine and airframe, autopilot, and weapons system. So far, the first two aircraft had done up to the time of our visit 760hr instead of a predicted 1,350hr flying, largely due to unforseeable snags. As far as weather has been concerned, in this inclement year the pilots say they have flown in "everything the gods have thrown at us."

A familiar sight at Culdrose nowadays is of two Wessex hovering over the airfield. This flying is carried out by day and by night, for the Wessex is being proved as an all-conditions aircraft in the detection and destruction of submarines. We were able to fly on a typical 2¼hr night sortie with the Senior Pilot, Lt Cdr Bagnall, sitting in the left-hand (co-pilot's) seat while he occupied his normal position on the right with the cyclic pitch stick at his right hand and the collective pitch lever on his left. A switch on the latter controls the extremely effective swivelling landing light with which the Wessex is equipped. This operates forwards, sideways or downwards and in landing provides an invaluable guide to height above the ground. We were nevertheless able to do one or two landings without it, but these involve much more care.

Conditions were extremely rough, with rain and with a wind gusting up to 40kt. The philosophy of 700H Flight is to treat the Wessex as a fixed-wing aircraft, and at night they normally taxy from dispersal to a take-off point. On this occasion, however, we made a direct ascent though the taxying potentialities of the Wessex (which has a tailwheel lock) were clearly shown when we returned to dispersal after the sortie.

One of the most interesting aspects of the flight was the demonstration of the autopilot system, which can be over-ridden by the pilot at any time by conventional use of the controls. A device is provided on the rudder pedals, taking the form of a microswitch which cuts out the autostabilizer yaw channel whenever the pilot's feet are placed on the pedals. The system is being extended to give full all-weather operation, incorporating a Doppler unit and radio altimeter. Coupled to the system, these enable the Wessex to be brought from forward flight to the hover and to a preset altitude above the sea. The system functions independently of the pilot and can be used in conditions of nil visibility. Height is held by the radio altimeter and the drift by Doppler. The autopilot is engaged prior to take-off, and during

Wessex and St Michael's Mount, the ancient castle on the 267ft-high cliff in Mount's Bay, linked to Marazion by a low-tide causeway

Proving the Wessex . . .

the sortie Bagnall demonstrated how the aircraft will counteract torque to maintain a heading with increased or decreased power, with the pilot's feet off the rudder pedals.

In our 2¼hr above Culdrose airfield, he was able to show me the Wessex cockpit in detail, with the following items displayed directly in front of the pilot: jet pipe temperature; torque meter; rotor r.p.m.; compressor r.p.m. (showing changes of throttle by a rapid change in r.p.m.); gyro compass (mainly, during our flight, slaved to the autopilot); radio altimeter; Doppler (giving an up and down cross reference for hovering at night); a.s.i.; ordinary gyro horizon; horizon giving degrees of climb; altimeter; rate of climb and descent indicator ("we are hoping," he commented, "to put in a more accurate, sensitive one"); an indicator showing feet of cable between the aircraft and the water; homer; fuel flow rate; hydraulic pressure indicator; servo systems; fuel gauges; transmission; oil temperature and pressure; and battery and generator switches.

On the centre console there is a twenty-channel UHF radio, on which frequencies can be set up manually; the autopilot; Doppler control box; HP/LP cocks; starter button, and landing light switches. At the top, in the centre, are the rotor brake, compass, HF and IFF, and Doppler control panel. Cabin heater, windscreen wiper and demister controls are fitted but the equipment was not operating in that particular Wessex. Subsequent aircraft will have these features in operation.

The pilots' seats in the Wessex cockpit (which has excellent all-round visibility) are hinged, to give access downwards to the crew compartment. Here, when the Wessex is flying in its anti-submarine role, the navigator and underwater control crewman sit side by side with their black boxes in front of them. Farther in front of the crewman is the sonar transducer equipment.

Lt Cdr Turpin, the CO of 700H Flight, said that it was in September 1958 that the first night dipping was carried out in a USN squadron. There is no doubt that with his considerable experience to guide them, 700H will prove the Wessex to be a potent and effective anti-submarine weapon. H. W.

Some of the pilots and observers of 700H: the CO, Lt Cdr Turpin, is standing at left; seated are (left to right) Lts Fraser, Munday, Humphries and Dullingham; standing (left to right) Lts Woodhead and Atkin, and Lt Cdr Bagnall, the Senior Pilot

700H Flight groundcrew, who have been maintaining a round-the-clock serviceability state, working on one of the squadron aircraft

Submarine hunter above its element: a Wessex of 700H Flight over an ebb tide on the coast near RNAS Culdrose (HMS "Seahawk")

PROGRESSIVE AIRLINE

PROBLEMS AND PROSPECTS OF AER LINGUS

BY GARRET FITZGERALD

PART 1

WE believe that there have been few articles about an airline, at any rate in recent years, as informative and stimulating as this one. The author is economic adviser to the Irish air companies. This article, and Part 2 which will follow in a forthcoming issue, first appeared as a series in the "Irish Times."

COMMERCIAL aviation is now four decades old, and Aer Lingus has celebrated its twenty-fourth birthday. Yet neither air transport in general nor Irish Air Lines in particular has yet reached maturity; both are growing and changing today as rapidly and as radically as at any time in their past history, and their development is unlikely to attain even a temporary plateau until after 1962. Few industries have had such a prolonged—and, the cynics might add, expensive—childhood and adolescence.

This prolonged development period is attributed almost exclusively to the rapid and continuous rate of technical progress in the industry, but it is worth commenting that it would have been considerably shorter but for the fact that prestige competition between governments during the 1920s and 1930s brought the commercial side of aviation into existence two decades before technical progress had reached the point at which an economic vehicle was put on the market. Under more normal conditions, commercial aviation would not have come into being on a significant scale until just before, or possibly even just after, the last war, and its period of development would then have been shorter and more normal.

Ireland was fortunate enough—or its governments were wise enough—to stay out of this prestige race, and to postpone entry into commercial aviation until 1936, when the industry was approaching the point at which it could begin to operate without massive subsidies. It is evident that we have lost nothing by this delay—far from running behind the rest of the world in managerial and technical experience as a result of our late entry, our airline has rather had the advantage of avoiding the long, slow organizational build-up which has saddled some of the older airlines with an administrative burden far beyond their needs or their financial strength.

The compactness of Aer Lingus has, indeed, throughout its history been one of the Irish airline's greatest advantages *vis-à-vis* its European competitors, most of which went administratively "out of control" in the immediate post-war period, and few of which have since fully recovered from these difficulties. Aer Lingus, it is true, suffered from a somewhat similar disease for a brief period of its history—during the latter part of 1947, to be precise—but the ailment was tackled promptly and vigorously. The fact that despite this temporary over-expansion, the company remained so much smaller in absolute terms than its European competitors, made it possible to carry through this pruning process more thoroughly and more effectively than in most of the larger companies.

Moreover, during the years after 1947 the small size of the company helped it to keep a close control over its overhead structure. Thus, for example, during the period 1953-59, when the capacity offered and sold more than doubled, the number of staff not directly concerned with actual flight operations rose by only one-sixth, while the number of operating, traffic and maintenance staff rose by barely one-third.

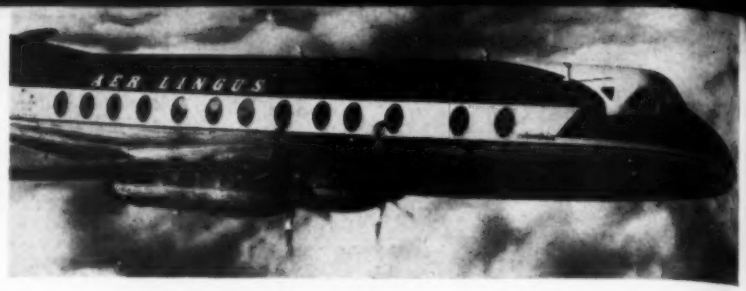
Cost Efficiency. This has led to one of the many paradoxes of commercial aviation in Europe—the fact that an airline whose size is generally considered to be well below the optimum level at which full advantage can be taken of economies of scale has nevertheless achieved and maintained a higher level of cost efficiency than almost any other European company. (By "efficiency" is meant, in this context, the level of cost per unit of transport capacity produced and sold, making due allowance for the effect of variations in basic operating conditions as between different companies.)

Aviation is one field in which direct international comparisons *are* possible, and the comparisons carried out by the Air Research Bureau (an organization sponsored by Europe's airlines) show that when allowance is made for differences in aircraft types employed and in the average length of sectors flown, Aer Lingus's operating costs are close to the European average—*despite the much higher burden of overheads per unit of production imposed by its small size, and the quite exceptionally seasonal character of its traffic and operation.*

This result has been achieved simply because good use has been made of the company's small size; instead of allowing the diseconomies of small-scale operation to weigh down its costs, the opportunity has been taken to achieve an administrative organization which by the standards of other companies is streamlined, and to achieve a degree of operational efficiency—matching the supply of the demand—that is the envy of the Irish airline's competitors.

This does not, of course, mean that Aer Lingus is efficient in an absolute sense—like any other organization of human beings, it falls far short of theoretically attainable efficiency in any number of different ways; nor are there any criteria by which to determine whether it is more or less efficient than other Irish firms operating in quite different spheres. It may indeed fall short of the standards

Dutch, American and British turbine airliners comprise the Irish Air Lines fleet—seven Fokker Friendships (as at right), one Boeing 720 (in heading picture) with two to come, and seven Viscount 800s



The Irish airline disposed of four of its Viscount 700s, two to Eagle in exchange for one V.800 plus cash and two to Tradair. The present Viscount fleet comprises seven V.800s, one of which is seen in this picture

PROGRESSIVE AIRLINE . . .

attained by other Irish companies, whether publicly or privately owned, but it is at least satisfactory to know that by international standards, within its own sphere, its achievements are highly rated.

This fact is of considerable significance in the context of the inauguration of Irish Air Lines' transatlantic route. For all practical purposes, Aer Lingus and Aerlinte are one company, with the same staff fulfilling in most cases the same duties, under the control of the same management—but with two different boards of directors.

If this expanded company could continue to maintain tight control over the size of its administration, and over the operation of its services, on the Atlantic as well as in Europe, then it would be uniquely well-placed to survive, despite its small size, in the struggle of giants that will take place on the Atlantic route and within Europe during the years ahead.

Expansion of Overheads. Some expansion of Irish Air Lines' overhead structure is, however, certainly inevitable during the present development period of the transatlantic service. Even before the inauguration of this service, there were indications that Aer Lingus itself had reached a point at which its administration was no longer adequate for the growing scale of its operations; it seemed, indeed, to be passing through the stage inevitably reached by all growing companies at one point or another in their development, when their original compact organization suddenly begins to give way all along the line before the pressure of sheer volume of business.

This situation must have been severely aggravated by the opening of the transatlantic route, and will be made even more acute by the enormous burden of work attaching to the introduction into service of a fleet of large jet aircraft by a company which has hitherto handled only conventionally-powered small and medium-sized aircraft.

Reorganization Problems. The success of the transatlantic operation, and, indeed, the continued success of the European operations of Irish Air Lines, thus depends to a very large degree upon the ability of the company to surmount the problems of this administrative reorganization, and to emerge from them with an organization which, while it must inevitably be less compact than the administrative structure with which it tackled successfully the problems of the 1950s, nevertheless, should remain relatively small and highly efficient by the standards of international aviation.

In part, the company's success in tackling this problem must depend, of course, upon its ability to find within its own ranks a sufficient number of skilled executives and supervisors to tackle the more numerous and difficult problems it will now have to face. If it fails to do so, it may face a critical situation, for its ability to recruit fresh executive talent from outside has been severely circumscribed by unremitting and short-sighted union pressure on the management to confine such appointments effectively to existing members of the staff. This means that the future management of the company must be drawn almost exclusively from the ranks of those recruited to the staff of the company while still in their 'teens—with the single exception of the annual graduate, whom the management is permitted to engage at the mature age of twenty to twenty-two as an alternative potential source of managerial talent! This may well prove, during the decade ahead, to be the Achilles' heel of a company whose success to date must in some degree be attributed to the free—even haphazard—methods of recruitment employed during its first period of rapid growth a dozen years ago.

Low Fare-levels. The fact that Aer Lingus has been able to keep its production costs down to the same level as other European airlines, despite the double handicap of its small size and highly seasonal traffic pattern, partly explains the low level of its fares. But this factor alone would not have made it possible to sell air transport at rates 20-30 per cent below the normal European level throughout the past decade, while earning a small operating surplus.

This abnormally low fare-level has been made possible by steadfast adherence to two policies which the company may be said to have pioneered in Europe throughout the post-war period. The first of these has been the policy of eliminating the unnecessary frills which elsewhere in Europe have pushed fares up to unnecessarily high levels. On cross-Channel routes to and from Great Britain, Aer Lingus has resisted all pressure to serve full meals, which on these short routes would increase the cost, and thus the fares, by up to 25 per cent in some cases. On Continental services, where passengers spend some hours in the air, full meals are, of course, served at appropriate times, the addition to the cost being proportionately smaller on these longer journeys.

Moreover, quite apart from maintaining this no-frills policy in the face of hostile and, in some cases, ill-informed criticism (many of the critics clearly imagine that meals served by airlines are really "free," and airily ignore their impact on the fare-level), Aer Lingus has throughout the past decade pioneered the policy of higher seat densities in aircraft, remaining at all times at least one step ahead of the rest of Europe in this matter. Space in an aircraft is almost as valuable as in the heart of London, and every unnecessary inch wasted on an inefficiently-designed seat, or on defective interior planning, has a startling impact on costs and fares. In the earlier years Aer Lingus concentrated on improving the interior layout of the aircraft, while during the past few years these developments have been brought a stage further by improvements in seat design sponsored by the company which have added to passenger legroom and general comfort while actually increasing seat density.

The other policy whose adoption over a decade ago has helped to keep fares well below the general European level is that of operating frequent services with medium-sized aircraft to a relatively large number of points, ensuring, by close control of the planning and operation of services, that a high proportion of seats are sold. This policy has enabled Aer Lingus to sell a higher proportion of seats offered than almost any other European airline—and this is clearly a vital element in the process of reducing the cost *per passenger*. The alternative philosophy (which has always commanded considerable support in BEA, for example) advocates the use of larger aircraft, operating less frequent services to a smaller number of points, with a lower proportion of seats sold—the aim being to make use of economies of larger size in aircraft design, and in ground handling.

Of course, the lower level of fares on Aer Lingus services applies equally to services operated by other airlines on the company's routes, for all air fares are internationally controlled. In practice over the years, however, Aer Lingus has had a relatively free hand in fixing fares on its routes at a low level, because of the fact that it is in a uniquely favourable position among European airlines in respect of its competitive position in international air transport. (Paradoxically, competition from other airlines, some of whom have a "high-fare philosophy," would almost certainly have led to fare increases on Aer Lingus routes.) On no less than half of the 24 international sectors which it operates in Europe, it does not have to share the traffic with *any* other carrier, and on three other routes—three of the busiest sectors in Europe—the competition it faces is at present restricted to a small, though growing, fraction of the total capacity.

No single factor explains this remarkable semi-monopoly situation. In part, so far as cross-Channel routes are concerned, it is a consequence of the original post-war Anglo-Irish Air Agreement which designated Aer Lingus as the sole Anglo-Irish operator on cross-Channel routes for while this agreement has been replaced, the situation it created has been only partially and gradually modified.

In part, it is attributable to a general lack of interest in Ireland among European airlines. SAS, Deutsche Lufthansa, Air France, Swissair, Alitalia, Iberia, TAP (Portuguese Airlines), Sabena—none of these airlines at present reciprocates Aer Lingus's operations into their national territories, although Sabena has twice done so for short periods. Some of these companies, of course, serve or have served Shannon *en route* to and from North America, but these flights carry very little traffic between Ireland and Europe and the stop at Shannon is scheduled either for refuelling purposes or to pick up or set down transatlantic passengers rather than with any intention of carrying intra-European traffic.

Finally, Aer Lingus's happy position in the matter of competition must also be attributed to its own initiative in opening up routes which the national airlines of other European countries simply failed to exploit. This applies in particular to the complex of services now linking Ireland with southern Europe through Lourdes, which during 1958, admittedly under special circumstances, carried over 52,000 passengers into and out of Lourdes Airport, and which last year was further extended with the addition of the Lourdes - Lisbon service.

Part 2 of this article will deal with, inter alia, *Fifth Freedom rights and the manner in which Aer Lingus is anticipating future problems.*

Giving Dimensions to Ideas

The drawing-office loft at Vickers, Hurn, is assuming a new importance—the reasons for which are discussed below

THE technical ability of aircraft drawing office staff is rising. Aircraft design technology is becoming such that new methods are being evolved to make more productive the men who really matter in a modern D.O.—the well-trained senior design draughtsman. By the same token, there may in five or ten years' time be less scope for intermediate draughtsmen or men who are not fitted by training to graduate to responsible positions.

These are the observations of the senior design staff of a drawing office that has been responsible for much of the design work on the Vanguard, is in the latter stages of scheming and detailing about one third of the VC10, has a special classified section working on the joint Vickers-English Electric project, the TSR.2, and who are well advanced with scheming a substantial part of the VC11 short-range transport. This is the Vickers-Armstrongs (Aircraft) drawing office at Hurn—a little remote perhaps from the circuit of aircraft manufacturers around London, but an active limb nevertheless of the large drawing office complex which is responsible for a major share of Britain's civil transport aircraft. A few weeks ago, the Hurn drawing, stress and weights-control office staff topped 500 for the first time, so that by any standards there is substantial capacity for the business of giving shape to ideas.

The process of change at Hurn is part of the pattern of increasing the productivity of senior designers. The familiar method whereby section leaders and designers scheme-out ideas for detailing by intermediate and junior draughtsmen is gradually giving way to a new system which relies very much more on lofting techniques. Because at some stage in the production of a component, its shape has to be marked-out full size, the argument is that it is logical to loft everything full-scale right at the beginning. Detail drawings can then be prepared by loftsmen from full-scale templates, and much of the tedious business of dimensioning detail drawings is reduced—work starts and finishes with the master loftplate.

Mating dimension, holes, pick-up points and so on can be checked by laying the "foil" of loft-produced details directly over the loft lines of the corresponding main assembly. Much of the most tedious of all drawing office work—the painstaking checking of detail drawings—is eliminated by the simple loft process of a visual check; and the senior men who are responsible for the scheme layouts which are the physical basis of all component design can be freed from many of their time-consuming supervisory tasks.

Two obvious ramifications of this are the part that, under this developed scheme, must now be played by the stress office, and the enhanced status of mould-loft draughtsmen. If the process is to be speeded up to the maximum extent, stress calculations must be made less from the complicated detail drawings (many of which, for doublers, stiffeners and so on need never be produced if full use is made of lofting possibilities) and more from designer's schemes. This pressure on the stress office to keep calculations abreast of design, rather than trailing behind it, is desirable if only to prevent this important department being swamped by detail drawings. At the busiest period on the VC10, these were being turned out at a rate of 350 a week.

All this entails increased responsibility for loft draughtsmen, and is another aspect of the philosophy that the economic operation of a drawing office is coming to depend upon the employment of rather smaller numbers of men of higher calibre. Many of the old chores of the lofting department—lettering and inking-in foils—can be done very well by girls, who in turn are elevated beyond the status of merely being tracers. At Hurn this part of the transformation has already taken place.

The Vickers drawing office is divided into sections dealing broadly with "structures" and "other than structures." Of the latter, by far the largest group are working on systems, and they are kept together because of the proven value of inter-change of systems information. Common problems of fuel and water-injection systems are such, for example, that the sections which deal with these are united under the common title of "fluid systems." Air conditioning and de-icing problems also have sufficient in common for these sections, also, to work in close proximity. Vickers' systems design relies upon continuity of experience within the design group, to which is constantly added a feed-back of information from the service department and the civil aviation development group.

Each part of every aircraft for air commerce is now subject to the preparation of a detail supplementary specification. Following on from the main aircraft specification, the supplement forms the basis of a contract between the manufacturer and the operator. The detailed specifications are really a guarantee of Vickers' responsibility for every part of the whole aircraft, and are thus painstakingly compiled from past experience with components on other aircraft, operators' requirements, and the results of the specialist knowledge of the Vickers' research laboratory. This is the detailed technique of designing reliability into the aircraft from the start.

Another interesting part of the work done at Hurn is on aircraft furnishing, especially that for the VC10. BOAC's VC10 interior has been styled by Charles Butler but responsibility for the decor is that of Mrs Gaby Schreiber. It is part of the business in hand at Hurn to translate these ideas of colour and style into drawings for the vestibules, toilets and galley units, and some big strides have recently been taken in the use of honeycomb structures for these components.

There are few clear-cut divisions in the work of the drawing office; modifications to one aircraft are still going on while project scheming of the next is already under way. So much more machining is involved in the production of an aircraft such as the VC10 than in any previous transports that drawings must now be completed further in advance than formerly of the appearance of the prototype. It is this which demands a greater production rate from the drawing offices in which transport aircraft are conceived and, in spite of recession elsewhere, Hurn still have ample scope for newcomers of a calibre to match this rate of progress.

At a chief designer's conference at Hurn on the VC11 are (left to right): A. E. Smith, in charge of the loft; J. G. Jennings, in charge of weights; E. L. Chivers, assistant chief designer; E. W. J. Gray, chief designer; F. H. Higgs, chief draughtsman; W. M. Brady (nearest camera), chief stressman; and J. P. Hinton, assistant chief designer

Straight and Level

THE other day I was driving past Speakers' Corner in Hyde Park, that hallowed shrine of free speech, when my attention was arrested by quite the largest gathering I had ever seen there—30,000 at a conservative estimate. This vast audience, evidently in a state of mass hysteria, was surging and swaying around a man on a platform who stood beneath a banner reading: EXPOSE THESE AVIATION S-MEN!

I ordered my driver to stop and walked over to join the crowd. The speaker appeared to be the mildest of men—he actually bore a curious resemblance to Mr Selwyn Lloyd—and he was obviously no professional rabble-rouser. But what he was saying appeared to be driving his audience to the extremities of indignation.

* * *

"And this is what I would like BOAC to tell me," he was saying. "FIRST, how much are they paying Douglas in dollars for the conversion of two DC-7Cs into all-cargo DC-7Fs? Why won't they tell us, eh?

"SECOND, why they are spending more dollars on aircraft they promised to re-sell for dollars?

"THIRD, are they now going to pay the £1.8 million import duty which they were excused in 1955 on the grounds that their DC-7Cs were a 'temporary import'?

"FOURTH, couldn't their own engineering staff have converted these aircraft, as they did the three Constellations for Skyways?

"FIFTH, if not, couldn't the work have been done elsewhere in the UK, eh?

"SIXTH, what about BOAC's surplus Britannia 312s—couldn't these have been converted into bigger and better freighters than the DC-7Cs?

"SEVENTH, the US airline Riddle has just bought seven ex-SAS DC-7Cs for $750,000 each. Did BOAC offer Riddle theirs for, say, $749,000 each?

"EIGHTH . . ."

At this point the maddened crowd went completely out of control, and had to be dispersed by fire hoses.

When order had at length been restored I sought out the speaker. Asked to explain what S-men were, he said: "S is for secrecy, old man. British aviation is full of S-men. Here, have this." He thrust into my hand a pamphlet entitled IT'S A SECRET. It was a list of 534 unanswered questions of public interest concerning British aviation, the latest being, "Why is the Anglo-German report on the Queen's Comet incident not to be published?"

I asked him his name. At this he laughed coyly, saying: "Sorry, old man, I can't tell you. Anyway, why do you want to know, eh?" And with that he vanished into the new Hyde Park underground car park.

Life Goes On—No. VI in the series: Douglas DC-2 "Hanssin-Jukka," now in use as a coffee bar in a park at Hämeenlinna, Finland. Once upon a time it flew with KLM as PH-AKH; during the 1939-40 Finnish-Soviet war it was mobilized and sent into action fitted with guns and bomb racks. Later it was used as a personal transport by the Marshal of Finland, Baron Mannerheim

● I am delighted to add the Fairey Atalanta and a Supermarine Southampton to my collection of retired aircraft still rendering service to the community. The Atalanta was a real giant of its day, with a span of nearly 140ft. The Southampton appears to be one of the metal-hull series built after 1926.

The reader who was kind enough to send me these pictures also mentions that the fuselage of the prototype Miles Aerovan G-AGOZ was at one time being used as a tool shed in a garden near Woodley aerodrome; that the Junkers Ju52 D-AUAV is used by the Reading Sky Observers Club as a club room; and that the wings of the Helw Aerogypt are doing service as part of chicken run in a garden near Whit Waltham. Any others? Pictures possible, please.

● *"After flying cross-country for several hours in good weather behind autopilot . . . I get out of the airplane and into my automobile and find myself serenely looking around at everything except the all-important road ahead."*—From the US flying magazine *Air Facts*.

● The story goes that a USAF C-135 took off from Frankfurt one overcast day and, as it made its instrument departure, the copilot was communicating with Frankfurt Control. Before each of his many calls he blew into the mike to make sure that it was live.

After he had split everyone's eardrums half a dozen times, a clipped British accent came up on the air: "I say there old man you have blown in my ear about five times—would you like to kiss me now?"

● *"The main obstacle to the growth of air cargo commerce has been the qualitative deficiency in the inventory of civil cargo aircraft."*—Mr James T. Pyle, deputy administrator of the FAA.

[Okay—so the aircraft weren't suitable.]

● "Here we have a great incentive programme. One mistake and you're fired."

● The *Daily Mail* reports that Sir Matthew Slattery, chairman of BOAC, flying to New York with his wife, wanted to meet some of the passengers. A stewardess made the introductions. "This," she said, "is our chairman, Sir Matthew Chatterley, and this is Lady Chatterley . . ."

ROGER BACON

Life Goes On—Nos. VII and VIII in the series: two flying-boat hulls in use as houseboats at Felixstowe. Left, the Fairey Atalanta, built in 1924. Right, a Supermarine Southampton of the late 1920s. See col. 2

The Independents, 1959-60

AN ANALYSIS OF BRITAIN'S PRIVATE AIRLINES

By J. M. RAMSDEN

THE annual report published each year by BIATA is probably unique among airline reports in that it does not attempt to present results in the rosiest possible light. This year's report,* just published, is no exception; though perhaps because the independents stand on the threshold of a new deal, comment is not quite so gloomy as in some previous years.

BIATA's unusual approach to annual reporting is quite understandable, since the political background to the independents' operations is such that they would gain little by emphasizing their successes. The corporation lobby in British aviation politics is more powerful than that of the independents, notwithstanding the fact that, like the Government, these operators stand for private enterprise. Thus the BIATA report and the meagre new statistical facts and figures that it offers have to be examined rather differently from those presented by BOAC, BEA and foreign airlines. For this reason we have turned to other sources for the tables presented in this review.

Though the minor key in which BIATA's successes are presented can be mildly wearisome, it is in a way rather refreshing to have to look for the best in an airline report. One of the best features of this year's edition, which as before is the work of the Association's small hard-working secretariat, is that the traffic statistics apply to the year ended March 31, in common with the results of BOAC and BEA. In past years BIATA's results have always been for the 12 months ending June 30; the past record has now been adjusted in the latest report.

How did BIATA fare in 1959-60? There are two tables of traffic statistics in the report, the first for scheduled services, the second for non-scheduled operations. The first table is based on information published five months ago by the Ministry of Aviation, and it thus provides no new information about the independents' scheduled operations. However, the table for non-scheduled operations provides new information about the major activity (66 per cent) of the independents.

*"The British Independent Air Transport Association: Annual Report for 1959-60." Published by *BIATA* at 8 Waterloo Place, London SW1.

"Flight" photograph

Only a small number of new aircraft have been ordered by Britain's independents, among them the Avro 748 feederliner—five by BKS, three by Skyways. Six Heralds have been ordered by Jersey Airlines

Unfortunately, any really worthwhile analysis of results, scheduled or non-scheduled, is vitiated by the fact that the figures are not broken down airline by airline. And this report is no different from previous ones in that it makes no mention of £ s d—the statistics that matter most. But it is possible to obtain a useful overall impression of progress.

First, BIATA's scheduled traffic. This increased by 14 per cent to 45m load ton-miles including ITs. One-third of all these load ton-miles were accounted for by freight, which showed the largest increases in the scheduled operations of the independents. Indeed, BIATA foresee that "freight could become responsible for the majority of the load ton-miles performed by the independents." Load factor on scheduled services (excluding ITs) was a healthy 67.3 per cent, no less than five percentage points up on last year.

BIATA does not break down scheduled traffic into its international and domestic components, but it appears from MoA figures that *international* scheduled traffic went up by 13 per cent and *domestic* traffic by 19 per cent. Load factors put on healthy weight in both spheres of operation. The report acknowledges this "genuine progress, which must obviously be regarded as satisfactory," but it feels bound to note that "improvement in some cases did no more than make good the previous losses."

Particular importance attaches to prospects in the international scheduled-service field, the report points out, as this is the "only category of operation which allows the earning of revenue-rates comparable to those enjoyed by other airlines." But it must be noted that though they still account for less than a third of BIATA's total effort, scheduled traffic went up by 13 per cent increase both relatively and absolutely.

Though the report does not give results broken down airline by airline, such results are in fact obtainable—ironically not from BIATA or any British source, but from the International Civil Aviation Organization. These results (see left) *Flight* has abstracted from the latest *ICAO Digest of Statistics, Traffic*. They apply to the calendar year 1959, but they are roughly comparable with the overall figures presented in the BIATA report for the March 31 year. They appear in Tables 1 and 2. This is, we believe, the first time that such figures have been published in the UK. It might be

INDEPENDENT AIRLINES 1959: SCHEDULED TRAFFIC

TABLE 1: INTERNATIONAL

Airline	Passengers	Passenger-miles × 1,000	Pass. L.F. per cent	Freight ton-miles × 1,000*	Total ton-miles × 1,000	Ov'll L.F. per cent
Air Charter†	87,733	7,970	47	2,870	3,650	69
Airwork†	9,044	37,700	73	97	3,550	76
BKS	25,519	6,975	44	25	553	46
Cambrian	5,096	1,435	26	—	131	26
Derby	643	155	41	—	14	37
Eagle	25,733	15,000	57	10	1,490	55
East Anglian	19,228	2,670	51	121	373	59
Hunting-Clan†	12,045	41,800	71	5,800	9,610	73
Jersey	49,386	3,950	71	6	347	63
Morton/Olley†	11,358	1,850	51	—	176	51
Silver City	262,984	16,250	49	5,590	7,200	72
Skyways	71,248	18,150	61	20	1,575	58
Starways	255	75	82	—	6	70
Totals	590,272	153,980	61	14,539	28,675	68

TABLE 2: DOMESTIC

Airline	Passengers	Passenger-miles × 1,000	Pass. L.F. per cent	Freight ton-miles × 1,000*	Total ton-miles × 1,000	Ov'll L.F. per cent
BKS	58,358	15,700	57	81	1,283	61
Cambrian	33,151	6,970	46	—	649	45
Dan-Air	338	54	47	—	4	42
Derby	18,632	4,410	54	—	378	49
Eagle	1,168	238	43	—	22	41
East Anglian	23,263	4,500	75	—	402	74
Jersey	105,102	14,000	75	16	1,222	67
Morton/Olley†	3,461	671	57	—	61	57
Silver City	94,045	10,920	65	28	1,018	67
Starways	7,528	1,305	79	—	106	72
Transair†	2,847	545	71	—	49	69
Totals	347,893	59,313	62	125	5,194	61

*Includes excess baggage. †British United Airways Company.

Source: ICAO *Digest of Statistics* No. 80, figures converted from metric, totals tally approximately with MoA figures.

Inclusive Tours (available ton-miles × 1,000): **Air Safaris** (non-BIATA), 1.4; **Airwork**, 588; **BKS**, 958; **Dan-Air**, 393; **Derby**, 631; **Eagle**, 2,215; **Hunting-Clan**, 1,785; **Orion** (non-BIATA), 57; **Silver City**, 1,825; **Skyways**, 17; **Starways**, 304; **Tradair** (non-BIATA), 489; **Transair**, 1,820. Total, 11,100.

TABLE 3: TOP-RANKING UK INDEPENDENTS, 1959
(Scheduled Services)

INTERNATIONAL AND DOMESTIC

Place	Passengers	Passenger-miles	Total load ton-miles
1	Silver City	HCA	HCA
2	Jersey	Airwork	Silver City
3	Air Charter	Silver City	Air Charter
4	BKS	BKS	Airwork
5	Skyways	Skyways	BKS
	International		
1	Silver City	HCA	HCA
2	Air Charter	Airwork	Silver City
3	Skyways	Skyways	Air Charter
4	Jersey	Silver City	Airwork
5	Eagle	Eagle	Skyways
	Domestic		
1	Jersey	BKS	BKS
2	Silver City	Jersey	Jersey
3	BKS	Silver City	Silver City
4	Cambrian	Cambrian	Cambrian
5	East Anglian	East Anglian	East Anglian

TABLE 4: BIATA FLEET, October 1960

BKS	Four Ambassador, four DC-3, one Bristol 170: five Avro 748 on order
British United	Two DC-6A, two Britannia 300, three Viscount 700, three Viscount 800, five Viscount 810, five DC-4, four DC-3, six Bristol 170, two Heron, five Dove
Cambrian	Two DC-3, one Heron 2
Cunard Eagle	One Britannia 310*, three DC-6A, nine Viking, two Viscount 700**, two Heron 1
Dan-Air	Three Ambassador, four York, three Bristol 170, two DC-3, two Dove
Derby	Six DC-3, three Marathon
East Anglian	Two Bristol 170, four Viking, three DC-3, three Dove
Jersey	Three DC-3, one Bristol 170, six Heron: six Heralds on order
Scottish	One DC-3, one Twin Pioneer
Silver City	Four Hermes 4, twenty Bristol 170, eleven DC-3, one Dove
Skyways	Four L.749 Constellation†, eight Hermes 4††, seven York, five DC-3: three Avro 748 on order
Starways	Three DC-4, two DC-3

*On lease. **Bermuda-registered. †BOAC-owned. ††Two with Bahamas Airways.

TABLE 5: NON-BIATA FLEET, October 1960

Air Condor	One Bristol 170
Air Safaris	One Hermes 4, three Viking
Continental	One DC-4, two Viking
Don Everall	Two DC-3
Falcon	Two Hermes 4, one Viking
Maitland Drewery	Two Viscount 700, one Viking
North-South	One Bristol 170
Orion	Three Viking
Overseas	Six Argonaut‡, six Viking, one Heron
Pegasus	Three Viking
Tradair	Eight Viking, two Viscount 700

‡Three others with the associated Danish operator Flying Enterprise.

Notes: Care has been taken to ensure that every transport aircraft heavier than the Dove, other than those operated by BOAC and BEA, appear in Tables 5 and 6, which are correct to October. The aircraft listed against each operator are those which are actually owned by that operator. The tables do not include aircraft which are on lease or operated under special arrangements (Overseas' two BEA-owned Ambassadors are a case in point). An exception is the listing of four Constellations against Skyways, these aircraft being actually owned by BOAC.

THE INDEPENDENTS, 1959-60 . . .

argued that if these figures are available to ICAO, presumably via the MoA, they might well be included in future BIATA reports.

Tables 1 and 2 allow illuminating comparisons to be drawn between one operator and another; and to show at a glance the top-ranking British independents in the various scheduled categories, Table 3 above has been compiled.

It is clear that had the former Airwork group been operating with Hunting-Clan in 1959 as British United Airways, they would have accounted together for more than half (actually 50½ per cent) of the whole of BIATA's scheduled load ton-miles. There is no doubt which is Britain's biggest independent in terms of the most commonly accepted measure of size—though Silver City carries by far the largest number of passengers, actually 38 per cent of the scheduled total.

A word here about inclusive tours. These slumped, to quote the word used in this context in the report, "distressingly" during the year. Seat-miles flown on ITs went down 16 per cent, compared with very big rates of expansion in previous years. What happened was not that fewer people availed themselves of packaged air holidays—rather the reverse—but that, as the report acknowledges, more people flew (1) on BEA scheduled-service inclusive tours, and (2) in the spurious "closed groups" on which the law has now clamped down. BIATA says it is sorry that licensing has had to be introduced for closed-group operations, "which have previously enjoyed freedom in an industry bound by regulations and restrictions." But it sincerely hopes that licensing will be "fully liberal, subject only to a check on the 'genuineness' of the closed group in question."

So much for scheduled services. Where BIATA's report does throw new light on the independents' year is in the field of non-scheduled operations. Measuring this type of traffic—charter and contract work—in terms of capacity rather than loads, since this kind of business is mainly *paid* for by charterers in units of capacity, it is seen that growth was a healthy 11 per cent.

Direct comparisons with previous years' results in the non-scheduled field is difficult, because past figures have not been readjusted to the March 31 year. But it is evident that trooping passenger-miles remained about the same as in the previous year, at 419 million—accounting for half of BIATA's total passenger-miles on *all* operations. Non-scheduled freight ton-miles went up by an encouraging 11 per cent to 57m.

The report of course does not show how much non-scheduled business is performed by non-BIATA independents. This is not easy to estimate, and it can only be done by roughly assessing the available capacity of the non-BIATA fleet, as shown in Table 5. There is no doubt that non-BIATA independent activities are growing, there now being 11 such operators, some of them, particularly Overseas Aviation, with high reputations, well-run operations and highly competitive prices. Non-BIATA activities are of course on a much smaller scale, but they are substantial enough for the BIATA report to be not quite right in suggesting that BIATA's contribution to the "total UK air transport effort" is 22 per cent, the remainder being produced by BEA (23 per cent) and BOAC (55 per cent). All these percentages have to be reduced if account is taken of the substantial non-BIATA activities.

Despite its limitations BIATA's report is the only available text on the activities of Britain's private airlines, none of which publish any report, and it is therefore a most valuable source of reference. Perhaps, as the Association grows in strength (and membership) in the coming years of greater opportunity and public accountability, it will come to publish more about itself.

KINDLY (BRITISH) LIGHTS IN AMERICA

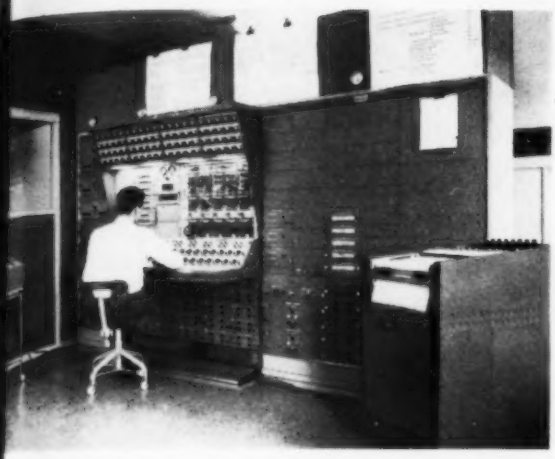
BRITISH visual glide-path indicators—the RAE-developed red/white light system—have been adopted by the Federal Aviation Agency as a standard for US airports. The British VGPI system was one of five evaluated at the FAA's National Aviation Facilities Experimental Centre at Atlantic City, New Jersey, and was recommended for selection by the FAA Bureau of Research and Development after an extensive test period in which both airline and general aviation pilots were invited to comment on the various systems installed at Atlantic City.

In the USA the RAE system can be installed for about $10,000 at airports with runways which already have an approach light system and for about $30,000 on other runways. The complete installation consists of a total of 12 light bars, three on either side of the runway at, respectively, 750ft and 1,250ft from the threshold, but a modification has been approved for use at smaller airports. In the latter case four units are used, two on each side of the runway, and 750ft apart. The FAA say that this can furnish quite satisfactory guidance for the types of operations normally carried out at the smallest lighted airports and that installation costs in this case can be as little as $1,500.

Apart from the sale by Thorn Electrical Industries of a small number of VGPI units for experimental installation, the RAE's invention will bring no dollar return from the US, though there are possibilities of substantial returns from elsewhere. Thorn are licensees of the RAE patent held by the National Research Development Corporation and Thorn and the RAE together have subsequently applied for a world-wide protection. It is under this arrangement that the US firm of Sylvania Electric Products of Waltham, Mass, with whom Thorn have an interchange in the lighting field, are to manufacture the RAE glide-path system in the United States.

FAA APPROVE LONG-STROKE LEONIDES

ALVIS LTD announce that the US Federal Aviation Agency has awarded Engine Type Certificate No 299 in respect of the Leonides 531/8 and 531/8B engines. These are fixed-wing variants of the new range of nine-cylinder radials in which the stroke has been increased from 4.41in to 4.8in, to make a "square" engine. Weighing 860lb, they have a maximum rating of 650 b.h.p. at 2,000ft and power the Scottish Aviation Twin Pioneer 3.



The Pace 231R analogue computer manufactured by Electronic Associates (represented in Britain by Electronic Associates Ltd) installed in the Saab computing centre at Jonkoping, Sweden. It has 100 amplifiers, an electronic multiplier group, X-Y plotter and eight-channel, hot-wire recorder

FLIGHT SYSTEM SURVEY

ATC Plan for 1965 to 1975

THE Air Traffic Control Board, formed last year to plan future civil and military ATC commitments, has recently formed the National Air Traffic Control Planning Group under the direction of Air Chief Marshal Sir Hubert Patch to "devise a joint civil and military air traffic control plan for the period 1965 to 1975." Representing the Air Ministry with Sir Hubert is Mr H. I. Roberts (D/SAAM). From the Ministry of Aviation are AVM Sir Lawrence Sinclair (Controller of Ground Services) and Dr J. S. McPetrie (Director General of Electronic Research and Development). Representing the Admiralty is Capt J. R. W. Groves (Deputy Director of Air Operations and Training). The joint secretaries are Wg Cdr G. C. Brunner (Air Ministry) and Mr W. C. Woodruff (MoA).

The formation of this planning group, which has already started work, marks a step towards definite long-term planning on a joint civil/military basis and will also have international significance because the ATC Board has already established a contact with the embryonic Eurocontrol organization. The Board's formation was first reported in *Flight* for December 4 last year and military air traffic control over Britain, with its inevitable civil implications, was discussed on August 19 this year.

Tacan for the RAF

TACAN receivers produced by Hoffman Electronics Corp are to become standard equipment in RAF aircraft and a direct order worth about $100,000 has also been placed for Hoffman Tacan test equipment.

Hoffman Tacan units, designated ARN-21C, have now passed the exceptionally stringent reliability tests laid down by the US Defence Department's special Advisory Group on Reliability of Electronic Equipment (AGREE) and proved a mean time between failures of 150hr during a gruelling 19-day environmental test sequence. Previous Hoffman ARN-21B receivers showed an MTBF of only 17.5hr during the AGREE tests although they had achieved between 70 and 90hr in service. Meeting the new requirements took two years and involved extensive re-engineering, a reduction in the number of parts to 5,600 and the introduction of rigorous quality control. AGREE testing will probably be applied to all airborne electronic equipment for the US Services and may be expected to lead to very considerable improvements in reliability. Hoffman claim to be the first company to meet the standards.

About 10,000 Tacan receivers are already being produced by Hoffman at the rate of 800 per week. Some of these will be supplied to the RAF. The USAF orders total $46m.

New Departures in Gyros

FOLLOWING closely on the announcement by Minneapolis Honeywell of the air-bearing gyro made of ceramic materials, comes the announcement of several entirely new forms of gyros for similar applications. They are electrically suspended spherical gyros by Minneapolis Honeywell and General Electric and a magneto-hydrodynamic gyro by the Speidel Corp.

The MH gyro was conceived by Dr Arnold Nordsieck of the University of Illinois and its only moving part is the beryllium spherical rotor which is electrically suspended in a vacuum. The rotor is spun-up by electronic means and then rotates freely for long periods. Optical pick-offs are used. MH say that they are developing a new inertial guidance system designed to take advantage of the greatly increased accuracies now possible. They have mastered the technique of machining the beryllium spheres and grinding and polishing them to extremely close tolerances. The housing is of fired and machined ceramics, bonded to metal. Diamond grinding and ultra-sonic drilling are also applied.

The GE gyro, too, is electrostatically suspended and has now operated successfully for 100hr continuously, according to *Aviation Week*. Automatic digital read-out shows the spin axis of the gyro relative to its mounting.

The magnetohydrodynamic gyro consists of a cylinder mounted within a sleeve, the space between the two being filled with mercury. Electric eddy currents induced in the mercury by stator-like windings impart a rotary flow to the mercury. Any force off the spin axis causes pressure gradients in the fluid which are sensed through ports in the closures at either end. Electro-mechanical sensers are used to detect pressure changes indicating the direction and magnitude of disturbing accelerations. With an input power of less than ten Watts an output of 0.1mm Hg pressure/deg/sec has been obtained.

Pye and Ekco Merge

IT has now been announced that Pye and Ekco are to form a joint holding company in which Pye will hold 75 per cent and Ekco 25 per cent of the shares of the combined £30.000,000 group. Mr C. O. Stanley, chairman of Pye, will become chairman of the holding company, with Mr E. K. Cole as deputy chairman. Both companies produce aeronautical equipment, among which are Pye ILS ground installations and a wide variety of VHF radio and Ekco airborne weather radar, CRDF equipment and precision approach radar as well as certain military equipment.

Telemetry Consortium

AT the recommendation of the Ministry of Aviation, five British electronics companies have formed a consortium to exploit the British and overseas market for a telemetry system developed by them in conjunction with RAE Farnborough. The companies are W.S. Electronics, who have been appointed negotiators for the group, Elliott Brothers (London), McMichael Radio, Rank Cintel and Southern Instruments.

The system has a line-of-sight range of 100 miles or more and employs a time multiplex transmission system. Information is displayed by the receiving equipment on the ground as meter readings, pen recorder traces and in digitized form for feeding into computers. It is already in operational use and many airborne transmitters and ground-based units have been supplied.

Marker Beacon for Beavers

AMONG the many radios to be carried in the Beavers now being delivered to the British Army is to be the marker beacon receiver from the Bendix 21-series radio produced under licence by Elliott Brothers (London) Ltd. The Beavers also carry a variety of VHF and UHF radios, Marconi AD.722 ADF and Decca Navigator. The Beavers will probably be able to fly airways and use ILS.

NASARR Orders for F-104s

LOCKHEED has ordered from North American Autonetics Division three prototype and 14 production NASARR attack radars, respectively designated R24A and R24B, for Canadian CF-104s. The Canadian Government has ordered a further 19 production versions and a technical assistance agreement has been signed to allow Canadian Westinghouse to produce the system under licence. Both single- and two-seat CF-104s will be fitted. The German air force has also ordered NASARR and production is under way at Autonetics. NASARR is a navigation, attack and interception radar designed for use in single-seat strike aircraft.

Doppler in the Westland Wessex

AN order for support equipment for the Ryan AN/APN-97A Doppler radar being fitted in Royal Navy Westland Wessex helicopters brings the total British orders with Ryan to about $2m. The APN-97A is used in conjunction with the Lear autopilot being manufactured as the Mk 19 by Louis Newmark.

Left, the Cessna Skyhook, accompanied by sample businessmen, brings something of a new look to executive flying. The cabin seats four. Right, Skyhook controls and instruments for the VFR model. In helicopter fashion, many of the controls are grouped on the stick and lever

Sport and Business

THE CESSNA SKYHOOK executive helicopter is now to be placed on the market at a price of $79,960 and the first production machines should become available next year. In taking this step, Cessna announced that they had entered the civil helicopter field after extensive research and development and after watching the market for some time. They will be able to back the Skyhook with their existing international sales and service organization.

The Skyhook has been developed from the military CH-1C and was certificated by the FAA for VFR operation during last year. In June this year it was cleared for IFR operation, but only the VFR version will initially be produced. A four-seater, it weighs 3,100lb loaded and 2,080lb empty. The four-seat cabin is located about the main rotor pylon with the Continental FCO-526A supercharged helicopter powerplant mounted in the nose and delivering 270 h.p. through only five gears to the two-bladed, all-metal main and tail rotors. The main fuselage structure is of sheet metal and a skid undercarriage is standard.

The two-blade rotor is conventionally controlled without power boost, but lateral stability is augmented by a mechanically-driven gyro which induces control movements proportional to roll rate and displacement. Longitudinal stability is assisted by an adjustable horizontal tail surface. Rotor r.p.m. range is from 280 to 320 and full engine horsepower is available up to 8,000ft, at which height the Skyhook can climb at 1,030ft/min at gross weight. Standard tankage of 60 US gal gives a range of 260 statute miles and endurance of 3.37hr. A 30-(US)gal extra tank is available. Hovering ceiling in ground effect is 9,600ft. Cruising speeds range from 90 to 120 m.p.h. and a marker on the a.s.i. dial can be set according to weight and altitude to red-line the appropriate maximum speed. Presumably, speed is limited by blade stalling.

Skyhook was designed specifically for mechanical simplicity and easy maintenance and has shown exceptional performance capability, particularly by setting up a world's height record of nearly 30,000ft in 1957. Distributors for Cessna aircraft, and therefore for the Skyhook, are Airwork Services Ltd, now temporarily based at RAF Booker, near Marlow, Bucks.

ABOUT 50 orders have been received for the Pushpak two-seater, which is constructed at Bangalore by Hindustan Aircraft. About 25 of these have already been delivered to flying clubs. The original price of £1,500 has been increased to about £1,700 but, according to a European source, since the prototype first appeared the aircraft has been cleaned up and a number of minor refinements to it have been introduced.

Winner of the latest Air Schools flying scholarship, enabling her to train to Private Pilots Licence standard at no personal expense, is Miss Irene Riding, a 24-year-old schoolteacher. Some 40 candidates competed for the scholarship at Elstree and Derby

THE FIRST JODEL D.1050 AMBASSADEUR to be registered in this country, G-ARFT, has been flown over from Bernay by Rollason Aircraft & Engines Ltd, the UK agents, and will be used as a demonstrator. Basic British price of the aircraft, which is a three-seater (or occasional four-seater, provided the two rear passengers together weigh not more than 16 stone), is £2,800. Equipped, as is G-ARFT, with eleven-channel VHF, full blind-flying panel, heater and stall-warning indicator, the type costs £3,350. Cruising speed is quoted as 120 m.p.h., with a six-hour endurance at a fuel consumption of four gallons per hour.

Rollason's Jodel D.140 Mousquetaire demonstrator, G-AOVZ, has been on the strength of the Tiger Club for the past few months and has proved most popular. Flights to France, Luxemburg, Czechoslovakia, Spain and Germany have been made.

RETROSPECT

From "Flight" of November 12, 1910

A Derelict Balloon: The inhabitants of Queen's Road, Peckham, were somewhat startled on the evening of the 1st inst. to find a balloon settling down on the roofs, and an air of mystery was given to the proceedings by the fact that the basket contained no passengers. It subsequently transpired that the balloon was the Hon. Mrs Assheton-Harbord's "Nirvana," which had broken away from her moorings at Battersea while being prepared for a cross-Channel trip. After a collision with a gasometer which tore a hole in the envelope, the gas escaped somewhat rapidly and so brought the balloon to earth, or rather the roofs of the houses. A good deal of damage was done to chimney pots and such like, and it was some time before the gang of workmen could get it down from the roof. This, however, was eventually accomplished and the damaged balloon was sent back to the works at Battersea.

COMPONENTS FOR THE BEAGLE executive aircraft may be produced in Scotland at the Linwood, Renfrewshire, plant of the Pressed Steel Co. Mr Peter Masefield, managing director of British Executive and General Aviation Ltd, said recently: "We have not yet got to the extent of deciding production arrangements but I think it is possible that components might be produced at Linwood. The prospect of building and assembling in Scotland is not likely." The BEAGLE company is a subsidiary of Pressed Steel, whose Linwood factory is at present producing bodies for Rover cars.

PAUL TISSANDIER DIPLOMAS were awarded at the recent meeting of the Fédération Aéronautique Internationale in Barcelona to Mr Harold Best-Devereux, Mr R. E. Hardingham and Mr L. C. Nash. Col R. L. Preston of the Royal Aero Club was elected an FAI vice-president.

A NEW LOW-WING PIPER, according to an American source, will be introduced next year and will probably replace the Tri-Pacer. Known as the Cherokee, the new type will be a four-seater with fixed landing gear and will have approximately the same power and price (160 h.p. and $10,000) as the Tri-Pacer. Another new Piper model, provisionally named Colt, will be a 108 h.p. two-seater reportedly costing less than $7,000 with basic instruments and radio.

A LUTON MAJOR is being constructed by members of the Waddington Popular Flying Group, whose membership is confined to RAF personnel at the Waddington station. Exhibited last month in the first RAF Art and Handicrafts Exhibition and Competition at the Air Ministry was the almost-complete fuselage of this machine, the first of two which the group hopes to build. Grants of £500 for each have been received from the Public Services Institute. The Waddington group, formed last January, now has about 80 members and operates a Taylorcraft.

Looking in on Avro 748 production at Manchester is Mr J. W. Booth (extreme left) of Aden Airways, who are to take delivery of three 748 series 2s in 1962. With him (centre) is Mr C. E. Fielding, Avro works director

AIR COMMERCE

CONVAIR'S MACH 2 PRESTIGE-LINER

A SUPERSONIC airliner that "would be quite competent to carry the American flag into foreign airports for prestige purposes" is a proposed major modification of the Convair B-58 Hustler Mach 1.5 plus bomber. According to Mr J. R. Patton, senior propulsion engineer at Convair's Fort Worth plant (whose words are referred to in a leading article on page 737), this modification involves new wing leading edges, new powerplants [twin J58s?] and a transport fuselage.

According to Mr Patton, NASA has a comprehensive test programme scheduled for 1961 using a B-58 at Edwards Air Force Base. This programme calls for the investigation of the handling characteristics of low aspect-ratio, high-wing-loading vehicles as applied to commercial use. It will also study all flight phases—take-off, climb, acceleration, supersonic cruise, deceleration, descent and landing. Other problems such as "proximity" flying, sonic booms, air traffic control, navigation, fuel reserves and so forth will be explored.

A modified pod has also been considered to assist in the evaluation of "human criteria" for supersonic civil passengers. "When we realize," says Mr Patton, "that it is possible to get as much as 0.7g deceleration when pulling the throttles back at Mach 2, we recognize the need for establishing new passenger acceptance limits before proceeding further." This modified pod, presumably attached to the belly of the B-58, will permit up to five people to cruise at Mach 2 for more than half an hour.

Mr Patton refers also to progress made by other US manufacturers. The North American B-70, he says, raises obvious possibilities as a "springboard" into the supersonic transport business. "This springboard has not been ignored in the least," says Mr Patton. North American proposes a programme which would include a "minimum modification" of the B-70 as a transport (using the existing J93-3 engines) by late 1963. By 1966 the company proposes a more extensive modification for MATS; and a version suitable for competitive commercial operation, with new powerplants, fuselage and systems, is envisaged for 1967. This programme would emphasize that "a firm basis of experience in Mach 3 cruising should be obtained before attempting to devise a detailed design or complete specifications for a triplesonic commercial aircraft."

Of Boeing's supersonic transport activities Mr Patton notes that the company has spent over $4m on project work and that the speed might be Mach 2 with provision for speed growth.

Other points made by Mr Patton, who was talking to a meeting of the Texas section of the IAS in Dallas, were: (1) Lockheed is reported to have spent $1½m on its supersonic project; (2) for 3,500 miles or more, Mach 3 would appear to be the desirable speed; (3) "almost everyone" feels it is mandatory that supersonic aircraft should be capable of operating from existing airports; (4) Convair foresee a narrow-delta configuration, they favour underwing powerplant pods, and anticipate L/D values of about 7.5; (5) present data for 300 to 350° soak temperatures are not available above 10,000hr, and 30,000hr would be the minimum for a commercial transport; (6) less than 500 total hours have been accumulated flying at Mach 2 [largely with the B-58]

CORPORATION CAPITAL

OF the 13 public investment programmes supported by the Treasury the national air corporations—BOAC and BEA—this year stand eleventh on the list of millions of pounds spent. In 1960-61, according to estimates in the Treasury White Paper* presented shortly after the re-opening of Parliament, the corporations will be tenth, receiving 3½ per cent of the total expenditure, and in 1961-62 they will be thirteenth and last, receiving only one-fiftieth.

But while twice the amount is to be spent on the air in 1960-61 than in the past year—£60m compared with £30m—in the following financial year Government investment will be halved again to near the former figure. For comparison the one-third of the total share accorded to the British Transport Commission is next year also to be sharply reduced, and the sum of capital investment available for British Railways is to be cut from £160m in 1960 to £125m in 1961. While Treasury support of surface transport places the BTC behind only electricity and housing in terms of Government financial support, less capital is being provided this year in support of BOAC and BEA than for, say, water and sewerage or the post office.

Most of the investment expenditure in the corporations is for aircraft and aircraft spares, but about one-sixth of the total covers the provision of ground-handling equipment and technical, office and sales accommodation. Expenditure for the years 1960-61 and 1961-62 covers the purchase for BOAC of its 15 Boeing 707s, 35 VC10s and ten Super VC10s, and for BEA ten Comet 4Bs (including those for Olympic Airways), 20 Vanguard 951s and 953s and 24 DH Tridents. Included in the BEA programme is provision for £2m to be spent over the years 1960-61 and 1961-62 on construction of the new permanent London Air Terminal at Cromwell Road. Money invested in the corporations is of course subject to interest payments from each year's operating revenues.

	1958-59 £m	1959-60 £m	1960-61 £m	1961-62 £m
BOAC				
Aircraft and spares	24.7	10.5	30.4	10.2
Other	2.3	2.8	3.4	4.4
Total	27.0	13.3	33.8	14.6
BEA				
Aircraft and spares	6.9	14.2	20.9	13.7
Other	3.1	2.3	5.8	4.8
Total	10.0	16.5	26.7	18.5
Total BOAC and BEA	37.0	29.8	60.5	33.1

The net book value of fixed assets shown in the balance sheets of BOAC and BEA at March 31, 1960, was £113 million and £50 million respectively.

AER LINGUS HAVE NEVER DONE BETTER

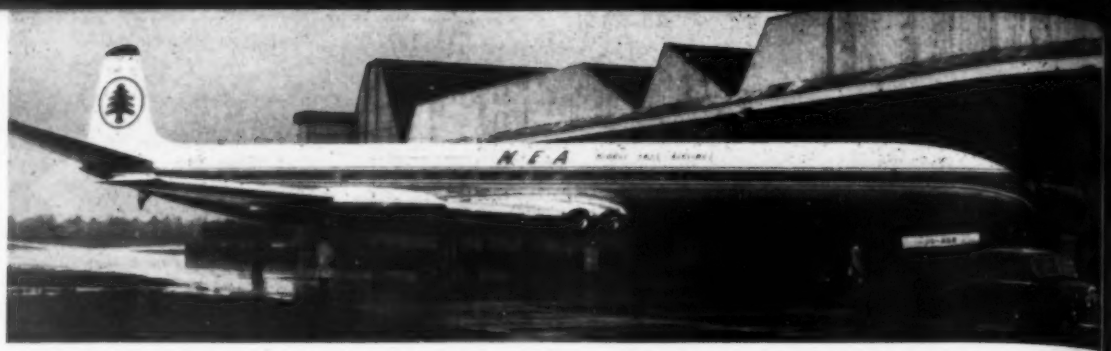
DURING the first six months of their twenty-fourth year of operations Aer Lingus Irish International Airlines achieved their best financial results since services commenced in May 1936. In the summer half-year ending on September 30, 1960, revenue from North Atlantic, European and United Kingdom routes amounted to £4.87m, while expenditure amounted to £4.42m, leaving a surplus of £453,000 before allowing for £50,000 interest on capital.

On the North Atlantic routes 22,812 passengers were carried—42 per cent of the total traffic between North America and Ireland—whilst on the United Kingdom and European routes a total of 477,224 travelled by the airline. The load factors on the western arm of the system attained 71 per cent—incidentally providing almost one-third of the overall revenue yield—and the eastern network achieved the high load factor of 73 per cent, possibly the best in Europe. Ancillary revenue from airport management and catering at Dublin showed a surplus of £106,500 for the half-year.

After congratulating all staff concerned in these efforts, Mr Jeremiah Dempsey, general manager of the Irish International Airlines system, commented: "There remains, however, one disquieting feature. Expenditure continues to chase revenue much too fast for comfort; and here I am referring in particular to such items as payroll and general overheads which show serious increases in a period when, for the first time in many years, we are experiencing reasonable stability in prices."

Footnote: An article dealing with economic aspects of Ireland's airline appears on pages 753-754 of this issue.

**"Public Investment in Great Britain." Presented to Parliament by the Chancellor of the Exchequer by Command of Her Majesty, November 1960. HMSO, price 1s 9d.*



Now undergoing final production checks, but still awaiting installation of its Rolls-Royce Avons, is the first de Havilland Comet 4C for Middle East Airlines. It is to be handed over to the airline in December, but Comet 4s chartered from BOAC are already being used to operate MEA's London - Beirut service at a twice-weekly frequency

AIR COMMERCE . . .

VEHICLE FERRIES GALORE

IF all the applications to operate vehicle-ferry services which are now before the ATAC receive approval, by next summer there could be a network of routes from nearly a score of provincial points in England to 16 or so terminals on the Continent.

The most recent application to operate vehicle ferries comes from East Anglian Flying Services of Southend. They have applied for the routes Southend to Bordeaux and/or Bilbao; Southend to Luxembourg; Bristol to Bordeaux and/or Bilbao; and Bristol to Jersey. Previously the same operator applied for a service between Bristol, Dublin and Cork, which has now been granted, while an application for a service to the same Irish terminals from Haverfordwest is still outstanding. Initially these new services would be operated with Bristol 170s, but ATL-98 Carvairs are stipulated for introduction later. East Anglian's request is for the carriage of vehicles and associated passengers, incidental passengers and supplementary freight at a frequency in accordance with traffic demand on each service for ten years from April 1961. Confirmation of a firm interest both in vehicle ferries and the aircraft which at the moment seems to offer the only profitable alternative to the Bristol 170, is shown by further applications to operate vehicle-carrying Carvairs on all of East Anglian's scheduled services (Ipswich - Southend - Rochester - Shoreham - Alderney - Guernsey and Jersey) and on their normal scheduled service to Paris over the routes Ipswich - Southend - Rochester and Shoreham.

It might be argued that carrying cars is no more than an extension of freight traffic, and doubtless this point will be made in the hearings when authorization of the addition of Carvairs to other types operating on East Anglian's present routes is being considered by the Air Transport Licensing Board.

It will be recalled that at the end of May another operator, Overseas Aviation (CI) applied for a Bristol 170 vehicle ferry service between Gatwick and Luxembourg. This application has not yet been heard by the ATAC but, as recorded last week, applications by Channel Air Bridge and Silver City to operate deeper-penetration routes into Europe have recently received British Government approval. The latter operator has also applied to operate an extensive network of vehicle ferry services from provincial originating points in Northern England now served with passenger services by its northern division.

Another vehicle ferry application for the operation of Bristol 170 services to the Isle of Man from Liverpool, Blackpool and Valley by Dan-Air, has been withdrawn following the introduction of additional sea-ferry capacity on this route, but the BKS vehicle ferry between Liverpool and Dublin, introduced this year, has been successful and is now to continue operating on a year-round basis.

VEHICLE FERRY SERVICES

Operator	Services Operated*	Services Applied For	Aircraft	Services Approved	Aircraft
BKS	Liverpool - Dublin				
Channel Air Bridge	Southend - Calais Southend - Ostend Southend - Rotterdam			Southend - Lyons Southend - Strasbourg Southend - Dusseldorf Southend - Bremen	Bristol 170 and Carvair
East Anglian Flying Services		Southend - Bordeaux/Bilbao Southend - Luxembourg Bristol - Bordeaux/Bilbao Bristol - Jersey	Bristol 170 and Carvair	Bristol - Dublin Bristol - Cork	Bristol 170
		Haverfordwest - Dublin Haverfordwest - Cork	Bristol 170		
		Ipswich - Southend - Rochester - Shoreham - Channel Islands Ipswich - Southend - Rochester - Shoreham - Paris	Carvair		
Overseas Aviation		Gatwick - Luxembourg	Bristol 170		
Silver City	Lydd - Le Touquet Lydd - Calais Lydd/Manston - Ostend Hurn - Cherbourg	Leeds/Bradford - Blackpool/Manchester - Liverpool - Glasgow/Edinburgh - Newcastle - Le Touquet Calais and Cherbourg Newcastle - Amsterdam	Bristol 170 and Breguet 763	Birmingham - Le Touquet Lydd/Manston - Troyes Lydd/Manston - Cologne Lydd/Manston - Pontoise	Bristol 170

*All present vehicle ferry services are operated with Bristol 170s.
Dan-Air's application for a Bristol 170 vehicle ferry from Liverpool/Blackpool/Valley to the Isle of Man has now been withdrawn.

Before the end of the year construction should start at Kai Tak Airport on a new passenger terminal for Hong Kong. Some idea of the size of the new building, in which up to 500 passengers an hour can be processed, may be gained from this model

This three tons-worth of £150,000 Remington Rand Univac computer has been installed at Remington House in London. It was flown from the USA by Pan American DC-7F

HARD-FLYING AUSTRALIANS

MORE flying per aircraft was done by Ansett-ANA's three Lockheed Electras in the twelve months ending in June this year than by any other type in Australia. TAA's three Electras and Mac.Robertson Miller's F.27 were worked very nearly as hard.

Aircraft utilization figures recently issued by the Australian department of civil aviation show that Ansett-ANA's Electras achieved an average daily utilization of 10.7hr (3,916hr per annum); TAA's Electras were operated at an average daily rate of 10.42hr (3,812hr per annum); and Mac.Robertson Miller's Friendship for 10.39hr (3,802hr per annum). Good utilizations were also achieved by Ansett's four Viscount 832s, which just topped the 3,000hr mark, and by TAA's 816s, which fell just short of this figure. The Australian statistics show also the astonishing annual utilization of Mac.Robertson Miller's DC-3s. An average of 2,710hr per aircraft confirms these as among the most hard-worked DC-3s flying anywhere in the world. In twelve months five aircraft amassed 13,550hr. By comparison—and a figure to make British cross-Channel car ferry operators envious—in the same twelve months 2,836hr were flown by Ansett-ANA's single Bristol 170.

All Australian turbine equipment on domestic services was kept busy in 1959-60, TAA's Viscount 756s, for example, returning an average daily utilization of 6.99hr and Ansett-ANA's Viscount 747s and 756s (the latter chartered from TAA) 5.93hr a day. Utilization achieved by Qantas-operated Electras, on the other hand, was not quite so good. The fleet was delivered in November and December last year and by the end of June had achieved a factored annual utilization of 1,614hr, or 4.41hr per day. One aircraft was chartered to TAA from March.

Another aspect of Australian air transport utilization, as revealed by the DCA statistics, is the number of hours which small operators wring from aircraft used on taxi services. Connellan Airways, for example, have since April been operating a Beech D.18 at a rate equivalent to 1,064hr a year, and their two C.18s have each achieved an average yearly total of 763hr flying.

JUDAH'S LION RAMPANT

UNTIL recently the leonine livery of Ethiopian Airlines' aircraft was familiar to few outside East Africa. However, a service to Frankfurt via Cairo and Athens is now in full operation, and in the near future the company plans to break new ground by introducing direct services between Ethiopia and West Africa. This expansionist policy has not only brought the attention of a growing section of the travelling public to this remarkable airline, but it has also heralded a dramatic improvement in the company's financial affairs.

Close study of the latest annual report for 1959 shows clearly the reason for last year's record profitability—the intrinsic economic efficiency of the DC-6B. In 1958 these aircraft were just getting into their stride on EAL's routes and accounted for only about half of the company's ton-mile output; last year, by contrast, this proportion had risen to two-thirds, the remaining third being produced by three Convairs and eight DC-3s. The impact of the three DC-6Bs was to be felt in a 10 per cent reduction in unit costs to the equivalent of 32 pence per c.t.m.—an extraordinarily low figure when account is taken of the peculiarly adverse environment in which EAL operate.

This low level of costs results in a break-even load factor of as low as 40 per cent, this in turn allowing the airline to show substantial profits, without hidden subsidy and after payment of all interest charges, on a revenue load factor of only 44 per cent. The seat load factor was even lower, a mere 36 per cent, the gap between these two percentages showing the extent to which Ethiopian depend on freight traffic to fill their aircraft, particularly on their extensive domestic network.

Despite their successful exploitation of the DC-6Bs, EAL realize that they cannot afford to go on operating these aircraft profitably in the face of jet competition, and an order has therefore been placed for two Boeing 720Bs. Although these aircraft are only expected to be put into operation at the end of next year, the first signs of their impending arrival were evident from the accounts for 1959. These showed a sharp increase in the amount of cash holdings to as high a value as Ethiopian $5 million (as against total assets of Eth $23 million). This cash will probably be used to repay some of the debt which has been incurred on previous aircraft purchases, otherwise the burden of fixed interest would be intolerable once further debt were incurred to finance the jets. This situation has arisen because Ethiopian Airlines has traditionally been financed by loans provided by the Imperial Ethiopian government; at the close of 1959 these loans represented no less than Eth $20 million (issued capital and reserves made up the relatively small balance of Eth $3 million). Most of this government loan capital has been made available against dollar credits from the Export-Import Bank. The same technique is to be used in financing the purchase of Boeing 720s, in this case the ExIm Bank having agreed to cover two-thirds of the purchase cost.

Now making its debut at London Airport is this 11½-ton BOAC cargo loader, of which three have been ordered by the corporation to cut down Boeing 707 loading times. BOAC estimates that a four-ton load of passenger baggage for a 707 could be off-loaded within 10min of arriving at the ramp. The vehicle, known as the Cargomaster, is made by the British firm Douglas

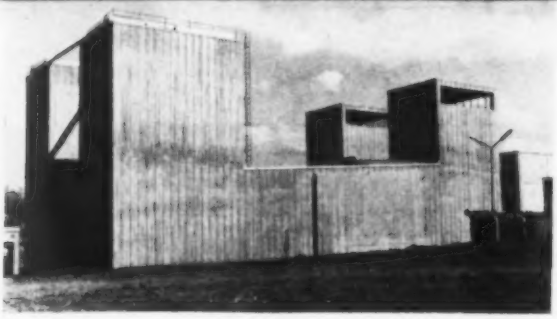
GIBRALTAR AIRWAYS FOURTH DECADE

WITHIN the next few months BEA Vanguards will be landing at Gibraltar and carrying on across the Straits to Tangier, serving the short route of Gibraltar Airways. It will be 30 years since the first five-seater Gibraltar Airways aircraft opened the service across the Straits.

Most references to Gibraltar Airways appear to show its date of birth as 1947, when D.H. Rapide operations across to Tangier began in association with the newly-formed BEA. But in actual fact the company came into being at the end of 1930, when the chairman of the Bland Line, Sir George Gaggero (then Mr George Gaggero) formed it as an offshoot of the major concern M. H. Bland and Co, of which he was—and still is—chairman and managing director.

There was no airfield at the Rock in those days, but Blands bought a Saro Windhover (three D.H. Gipsy 2s). The service to Tangier lasted two months before being suspended as uneconomic and the aircraft, which was chartered by the Hon Mrs Victor Bruce, ended its days by crashing into a hillside in Andalusia.

The airline lay dormant but the company was kept alive and was ready to offer its rights to BEA as a partner in August 1947. Three Rapides started flying then, each bearing the name Gibraltar Airways, and services were operated in association with BEA to Tangier, Malaga, Granada, Tetuan, and Seville. The



SAS test-run the Pratt & Whitney JT4 engines of their DC-8s at Bromma Airport, Stockholm, in these sound-proof cells produced by the Metal Products division of Koppers Company of Baltimore

AIR COMMERCE . . .

visit of the Queen to Gibraltar in early 1954 put an end to operations in Spain, and the Rapides were disposed of, services then being flown by a BEA Pionair which returned to London once a month for overhaul, carrying soldiers at a specially low bargain fare.

In 1958 BEA Viscounts began to operate a through service from London to Tangier, landing at Gibraltar and changing the flight number. A year later, Royal Air Maroc took up its reciprocal rights, and now flies the Tangier - Gibraltar service four days a week.

As at present constituted, Gibraltar Airways enters its fourth decade with the same chairman, Sir George Gaggero. Deputy chairman is the Earl Amherst, while the remaining board consists of: Mr W. A. Caro (manager for BEA in Spain); Mr A. C. Ping; Mr J. L. Cabedo (director of Bland Line in Tangier and nephew of the chairman); Mr Joseph Gaggero (elder son of Sir George); and, as an alternate director, Mr John Gaggero, younger son of Sir George.

OVERSEAS AVIATION'S AMBASSADORS

EARLIER this week Overseas Aviation were due to take delivery of the first of the four Ambassadors that they have purchased from BEA (*Flight*, October 7, page 563). Overseas now join BKS, Dan-Air and Shell as operators of these well-liked passenger aircraft. Overseas Aviation's tentative plans to resell two of these aircraft are not at the moment being proceeded with. This is due, it is understood, to the large volume of business the company has in hand.

A note about Overseas' Ambassadors on page 758 of this issue ("The Independents 1959-1960") is based on information published by the ARB in the October 1960 edition of the *British Register of Civil Aircraft*, the latest issue available when that article went to press.

LAST WORDS ON MUNICH?

ON February 6 it will be three years since the BEA Elizabethan accident at Munich Airport. Last week, following the Fay Commission report to the Minister of Aviation (see "New Literature on Slush," *Flight*, October 21), the commander of the aircraft, Capt James Thain, was dismissed from BEA on three months' notice. The Commission decided that Capt Thain was at fault in not making a personal inspection of the wings before reaffirming his decision neither to sweep them nor to de-ice before he took off.

Since the accident Capt Thain has been suspended on full pay of £2,200 a year, and when he leaves the corporation on February 8 he will qualify for a pension of £450 a year.

Previously notified by the Ministry of Aviation that his licence could now be renewed, Capt Thain said after receiving his dismissal notice that he would appeal. Last week he was asking, "I wonder whether BEA are going to help me get my licence back? I need flying practice. And as a pilot who served them for so many years I think the least they can do is to see that I am qualified again when I leave them."

Here is Aerad Flight Guide in its new "easy-to-read" format, with approach and landing charts now on single sheets. An open-flat plastic binder is used so that amendments can more easily be made

JAL GOES GLOBAL

WITHOUT doubt the most significant feature of the latest annual report for Japan Air Lines is the outline route map on the inside front cover. In contrast with the continuous lines showing existing JAL international routes to California and to South East Asia, dotted lines depict projected routes which will transform JAL from an oriental into a global organization.

Particularly striking are three planned routes from Tokyo to Paris—one an extension of their S.E. Asia route through the Middle East, another an extension of their California services to New York and on through London, and a third over the North Pole and on across Scandinavia. Other projected routes are Tokyo-Peking and Tokyo - Manila (an illustration, incidentally, of Japan's studied neutralism); an extension of the Los Angeles service to Brazil; and a dog-leg between Paris and Moscow. This meteoric programme, which will involve at least a doubling of JAL's route mileage, can best be seen in perspective when it is remembered that it follows on the heels of a 50 per cent increase in mileage in 1959-60, as compared with 1958-59, to 27,000 unduplicated route miles.

JAL's operations in the year ended March 31, 1960, divided into three neat sections: trans-Pacific services, almost entirely operated by the company's four DC-7Cs, accounted for just over half JAL's entire business; services to S.E. Asia, which use most of the capacity of five DC-6Bs, represented an eighth of total traffic; while domestic services within Japan, most of which are flown by a fleet of ten DC-4s, accounted for the remaining third. All services are operated at the high average load factor of 67 per cent (64 per cent international, 77 per cent domestic), and this, coupled with low unit costs (equivalent to 34 pence per c.t.m.), allows the airline to show a profit margin of two per cent on revenue after all financial charges are taken into account.

The financial year 1959-60 was, however, only the second profitable year in the company's short history, the dead hand of earlier losses being apparent from the large amount of money that has been poured into the airline in relation to the volume of turnover. In 1959-60, for instance, JAL capital stood at high as £19 million, some 50 per cent greater than the annual revenue figure of £13 million.

Although the bulk of JAL's present business is with the United States—and this is apparent from the Americanized appearance of the annual report—the future is likely to be closely tied up with France, for JAL has now concluded a revenue pool with Air France to cover the Japan - Europe services. Already Air France aircraft are flying between Tokyo and Paris with JAL insignia. Next year will see JAL's own DC-8s on the Polar route, while Convair 880s will follow on later on the route via S.E. Asia. Unless the American trust-busters intervene, it seems likely that JAL's future annual reports will owe more to the Eiffel Tower than to the Empire State Building.

CARTER BKS

FOR the carriage of freight to and from Northern Ireland, the Irish firm of Air Freight Containers and BKS have co-operated to produce lightweight containers which will be used on a new twice-daily scheduled freight service between Leeds/Bradford and Belfast. BKS hope to start operating before the end of the year. Later, services from Belfast will be extended to include Newcastle, Edinburgh and Luton—all routes on which BKS hold freight licences. An application has also been made recently to operate freight services between Belfast and Prestwick.

Part of the service will include door-to-door collection and delivery to connect with flights leaving at fixed times each day. A despatch-delivery time of less than 24hr is envisaged, and between some points morning despatch and evening delivery should be achieved. All routes will be operated with BKS Bristol 170s, for which several sizes of glass-fibre containers have now been developed. It is claimed that loading and unloading and securing problems—both of the freight within the container and of the container itself—have now been overcome.

SCOTLAND'S TROUBLED AIRPORTS

NEXT April, when Turnhouse Airport, Edinburgh, is closed for four months for runway strengthening, a temporary airfield must be found to take its place. Originally it was planned to strengthen Edinburgh's runway by night, but this idea had to be abandoned when it was found that the load-bearing strength was lower than had been thought; 1,700ft of the centre of the runway will have to be dug up.

None of the three airports suggested as temporary alternatives provides a fully satisfactory solution. Leuchars, the RAF fighter airfield in Fife, is too inaccessible from south of the Firth of Forth. Renfrew is already over-congested and proposals for its replace-

This is Seawell International Airport, Barbados, at which a new terminal building has recently been opened to cater for about 40,000 incoming passengers a year. Well-equipped with concessions, Seawell last year operated at a profit

ment are under discussion; and East Fortune—a disused airfield 23 miles east of Edinburgh, south of the Firth of Forth—would require £20,000 to be spent on it before it could be used.

It is understood that the decision of the Ministry of Aviation and of BEA is that the best of these available alternatives is East Fortune, and that they have recommended to the Treasury, whose sanction must be obtained, that this is where BEA should fly during the early summer. The runway is 6,000ft long and is in reasonably good condition, but mobile control and other equipment would have to be brought in, and the corporation would have to make arrangements to get its staff to and from the airfield. Ways will also have to be found of making the existing buildings suitable for use by BEA's passengers.

FARE PLAY BY CANADIAN AIRLINES

CANADIAN airline fares in North America are to be drastically revised on a basis of actual route operating costs. New tariffs, which in general will bring about an overall reduction in fares, are to come into effect on TCA and CPAL routes on January 2 next year. Excursion fares will also be introduced.

Balancing of fares and costs was achieved in a twelve-month study of cost curves for the aircraft operating in Canada and to the United States, from which an average compound curve was produced. Balanced against present tariffs, fares on long-haul sectors—above 600 miles—should be reduced, fares over 400 to 600-mile stages will remain unchanged, and short-haul fares will be increased. Excursion fares, which will be applicable for 23- or 24-day periods between September 30 and June 1, will be 25 per cent lower than the standard tourist (now called "economy") fares.

15HR A DAY FOR TIGER'S CL-44Ds

"WE have convinced ourselves," says Mr Robert W. Prescott, president of the Flying Tiger Line, "that eventually we can operate the CL-44 at a rate of 15 to 16hr a day." It takes Flying Tiger four hours to turn round an L.1049H with a 40,000lb payload and the airline intends, he says, "to turn round the CL-44 [which has a payload of more than 60,000lb] in less than 45min."

He adds: "To give you an idea of our own forecast in the immediate future, our present fleet capacity is about 160 million ton-miles a year. The annual capacity of our first order for CL-44s is about 600 million ton miles. We have to more than double our present business in the year starting June 1961 or we will be in serious trouble. We have no doubt we can do it. We expect to triple business the second year and more than quadruple business in the third year."

BREVITIES

Hong Kong is an intermediate point on the Tokyo service planned by Lufthansa for inauguration early next year.

Air Africa's capital of NFr 800,000 (£58,000), according to a report in *Interavia*, will be subscribed 50-50 by Air France and UAT.

Mr R. E. Phillips has relinquished his post as chief inspector with Air Couriers and has joined A. J. Whittemore (Aeradio) Ltd as commercial manager.

Signing of the official Eurocontrol agreement, expected this month, has been postponed until the first quarter of 1961, reportedly at Dutch request.

Air France has confirmed a repeat order for six Caravelles, bringing the total order by this operator to 35. One of the six will be for Tunis Air and another for Air Liban.

British United Airways have inaugurated a new Heron twice-daily service between Gatwick and Rotterdam. Flights can be combined with the Channel Air Bridge services between Southend and Rotterdam.

The Peruvian capital's old airport at Limatambo is now replaced by Lima International at Callao. It was opened on October 29 by President Manuel Prado of Peru. Total cost is estimated at £2.9m.

An air agreement was initialled by governments of the United Kingdom and of the Republic of Indonesia in London on November 2 to provide for mutual facilities in their respective territories for the operation of scheduled services.

A DC-3 operated by the Royal Nepal Airlines Corporation crashed after take-off on November 5 from Bairihawa in West Nepal, about 100 miles from Khatmandu. The four crew members, who were the sole occupants, lost their lives.

Aeronaves de Mexico have ordered one DC-8, and have taken immediate delivery. Alitalia have placed a repeat order for two DC-8-40s (Rolls-Royce Conway version) to bring their total fleet to eight. DC-8 sales now amount to 156 of which about 100 have been delivered.

A BEA Comet 4B taxying out for take-off at Zurich on November 6 suffered a fracture of the nosewheel axle and the loss of both nosewheels. After a similar incident at London Airport on October 29 (*Flight* last week), which caused the BEA and Olympic fleet to be temporarily withdrawn, D.H. called for crack-inspection by (1) dye-penetrant and (2) chrome deposit and shot-peening. After the second incident axles were replaced. It is understood that an axle sleeve is to be retrospectively fitted. [Note: Individual BEA Comet 4Bs have completed more landings and take-offs than those of other operators.]

Sir Matthew Slattery, chairman of BOAC, left London on November 1 for a five-week tour of the Caribbean and South America. He will meet Government civil aviation and tourist officials as well as BOAC staff.

SAS has become a Viscount operator: the airline has chartered a Fred Olsen Viscount 779, one of four previously chartered by Austrian Airlines, for use on domestic services.

Bristol Britannia 312 G-AOVA has been sold by Bristol Aircraft as 9G-AAH to Ghana Airways, to bring that airline's Britannia fleet to two, the other aircraft being a 309. Bristol Aircraft have now disposed of their small Britannia stock.

A TWA Martin 404 recently collided with a flock of wild geese 50 miles north of Pittsburgh. The collision "dug a two-foot hole in the nose and ripped the port wing and fuselage." The commander, Capt Samuel H. Mariani, returned to Pittsburgh.

Provision for short-range jet transports appears in a five-year plan recently issued by the aviation sub-committee of the Japanese Liberal Democrat party. Three would be required for domestic trunk routes services in 1963, 11 in 1964 and 16 in 1965. Feederline services in 1964-65 would be operated by 10/15 YS-11s.

The annual general meeting of the Guild of Air Pilots and Air Navigators will take place at 6.45 p.m. at HQS "Wellington," Temple Stairs, Victoria Embankment, London WC2, on Thursday, November 17. The a.g.m. will be preceded by the Annual Service at 5 p.m. at St Michael's, Cornhill, EC3.

An application for type certification of the Potez 840 has been made to the FAA by the Potez-Air Fouga technical management. The prototype should fly next February, and the second aircraft may be demonstrated at the Paris Salon. According to *Interavia* another two prototypes are to be built, one for static tests and a second equipped with engines other than Turboméca Astazous.

A Hermes 4 VP-BBP of Bahamas Airways lost a propeller while taking-off from Nassau on October 16 on the service to Miami. A report from Lloyds' Agents says that it "damaged No 3 propeller, tore through the nose of the fuselage, struck the ground, bounced and tore a large hole in the tail of the fuselage. Damage to the aircraft is quite extensive and, in the opinion of the Director of Civil Aviation, it may be a constructive total loss." The Hermes is one of two ex-Skyways aircraft which, specially converted, inaugurated Bahamas Airways services from Nassau to Miami, Fort Lauderdale and West Palm Beach on February 1 last (*Flight*, January 29, page 162, and February 19, page 256).

Gloster Javelins are the first Fighter Command aircraft to be equipped for air refuelling, and at left—seen with a Vickers Valiant tanker of No 214 Sqn—are two Mk 9s of No 23 Sqn, four of whose machines recently carried out a proving flight from the United Kingdom to Singapore, making only three intermediate stops. Above, a close-up view of one of the squadron's Javelins (based at RAF Coltishall, Norfolk, and equipped to carry Firestreak), showing the refuelling probe

SERVICE AVIATION

Air Force, Naval and Army Flying News

Khormaksar "At Home"

NEXT Friday (November 18) RAF Khormaksar, Aden, is to be open to the public for the first time since the Royal Air Force moved there thirty-five years ago. A display is being given to mark the 20th anniversary of the Battle of Britain and amongst those invited to attend are emirs, sultans and sheikhs from the Western Aden Protectorate. Participating aircraft will include a solo Hunter from Khormaksar-based No 8 Sqn, the Hunter aerobatic team of No 208 Sqn (from Eastleigh, Kenya; depicted on this page on October 28), V-bombers, a Comet and Britannia, and Shackletons, Twin Pioneers, Valettas, Sycamore and Beverleys. Nine types of aircraft operate from the station.

Nottinghamshire Team

LATEST recruit to the team of RAFVR pilots who give air experience to cadets at RAF Newton, near Nottingham, is Reg Simpson the Nottinghamshire and England cricketer. As Fg Off R. T. Simpson, he joined No. 7 Air Experience Flight at about the same time as an unrelated namesake, Fg Off J. Simpson. Their membership brings the total flying strength of No 7—one of thirteen AEFs which have been operating in various parts of the country since September 1958—to 14 officers, headed by Flt Lt Ken Jones (who is regular RAF) and Flt Lt Hector Taylor.

The Newton flight operates three Chipmunks and serves four wings of the ATC (Nottinghamshire, Lincolnshire, Derbyshire and Leicestershire, including Rutland) and the RAF section of the Combined Cadet Force in 19 public schools. Flying experience is given to about 30,000 boys every year, and it is proposed that in the future similar facilities will be extended to girls in the Junior Air Corps.

IN BRIEF

Queen Elizabeth the Queen Mother is to visit the Central Flying School, RAF Little Rissington, on November 16.

The Queen's Colour for the Royal Air Force in the United Kingdom was ceremonially handed-over to its new custodian, the RAF Regiment, at Uxbridge, on Tuesday, November 1.

Air Marshal Sir Frederick Scherger, CAS of the RAAF, has been appointed chairman of the Australian Chiefs of Staff Committee. He succeeds Vice-Admiral Sir Roy Dowling, who is retiring.

Gp Capt G. C. Godfrey is to become SASO at Signals Command Headquarters from December 22, with the acting rank of air commodore. He has been a Deputy Director of Operational Requirements at Air Ministry since March this year.

Victors of RAF Bomber Command and RAAF aircraft from Butterworth (four Sabres and a Canberra) are participating in the Military Air Display at Manila on November 27 during the 13th Philippine Aviation Week (November 21-27).

A New Zealand Government commission of inquiry has described as "a mistake" the failure of RNZAF officers to tell the Government that reconditioned engines had been substituted for new ones in Canberras ordered from Britain in 1957. But the commission has found that no officer was personally guilty of any breach of duty.

Six Hunters are to fly past on November 14 to inaugurate a five-day RAF careers exhibition at Plymouth.

RAF personnel seconded to the Ghana Government have taken over the re-organization of the Ghana Air Force and the training of crews. The first Ghana Air Force base is to be at Takoradi and will begin operating next March.

The prototype CF-104 for the RCAF made its first flight recently from the Lockheed Aircraft Co airfield, Burbank, Cal. Described as "a modified early model Starfighter . . . with an advanced electronics system," the CF-104 is to be licence-produced by Canadair and will replace the F-86 Sabre in NATO-assigned RCAF squadrons.

The first night casualty evacuation by a Twin Pioneer of No 78 Sqn was carried out recently when a British serviceman suffering from acute appendicitis was flown 100 miles from Mukeiras in the Western Aden Protectorate to RAF Khormaksar. The aircraft, piloted by Sqn Ldr J. H. Phillips, landed at Mukeiras—6,700ft a.s.l. and situated in an enclave surrounded by an 800ft-high ridge—on a flare path provided by paraffin lamps and Land-Rover headlights.

Admiral Sir Walter Couchman, the first full admiral in the Navy to pilot jet aircraft, who has been placed on the retired list at his own request. Aged 55, he has been Vice-Chief of the Naval Staff since February and was previously Flag Officer, Air (Home)

All RNZAF training aircraft, with the exception of four Devons of the Transport Wing, are to have "fire orange" fluorescent markings.

Shackletons of No 37 Sqn from RAF Khormaksar, Aden, were engaged on anti-submarine duty in the CENTO exercise Midlink Three which took place in the Arabian Sea off Karachi from October 25 to November 9.

Past and present officers and members interested in attending the next Aberdeen UAS annual dinner—at the Royal Athenaeum Restaurant, Aberdeen, on Saturday, December 3—are asked to write as soon as possible to the Secretary, Aberdeen University Air Squadron, Powis Gardens, Bedford Road, Aberdeen.

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

Aircrew Systems Specialist

SURELY the best way to guard against unserviceability of automatic landing equipment at the end of a flight is to carry a systems specialist in the operating crew and have the equipment checked and any power supply or component defect rectified before commencing descent.

To quote Mr Majendie, of Smiths Aviation Division, with regard to airborne computers: "They would have obvious applications in VTOL and supersonic vehicles and the function of man in systems of this kind would be as systems manager."

The man is there on our long-range aircraft and is being trained in electronics and radio maintenance. Isn't it time our medium-range operators recognized the inevitable technical trend and employed properly trained flight engineers on the systems panel?

Maghull, Liverpool IAN CARTER

Preserving a Sunderland

THE latest development in the year-old campaign to preserve a Sunderland is a very generous gesture by the French Admiralty. Following a letter sent to the French Admiralty by Air Chief Marshal Sir Philip Joubert, Admiral Suquet, Chief of the French Naval Air Service, offered in his reply to make the Sunderland available free of charge. All that was requested was a letter from the British Air Ministry, explaining exactly what the aims of the campaign were.

This letter has now been sent by the Air Ministry, stating also that the project, although not sponsored or financed officially in any way, does nevertheless meet with the Ministry's wholehearted approval.

Needless to say, I wish to express my deep appreciation of this very generous gesture by our French friends. I am also grateful to the Air Ministry, from whom by far the greatest proportion of help has come. In every possible way, they have acted promptly and painstakingly to assist the campaign to a successful conclusion.

Application for use of a site at Pembroke Dock has been sent to the Admiralty. Pembroke Borough Council are backing the project and a reception will be arranged for the French crew when the Sunderland arrives. Care and maintenance will be carried out by volunteers, such costs as do arise to be met by "gate money" from the public. All the French aircraft saw service with the Royal Air Force during the last year of the war.

Pantgwyn, Cardigan PETER F. M. THOMAS

Fuel Duel

LORD BRABAZON'S challenge to a "fuel duel" spotlights the cardinal safety feature of kerosine relative to JP.4, namely, its low initial rate of conflagration in that class of accident in which fuel is spilled and passengers are not killed by impact. The other major difference concerns the vapour spaces in the tanks. With kerosine these are rarely explosive; with JP.4 they normally are highly explosive. From the safety viewpoint all other characteristics of the two fuels are insignificant.

Please enrol me for Lord Brabazon's "fuel duel." For good measure, I will stand in my kerosine pool wearing bathing shorts, and I will use a lighted taper or blowlamp for more positive ignition; the JP.4 man is invited to follow suit.

Further, I invite any JP.4 advocate to a complementary "duel" to reveal the other important safety difference mentioned above. Each contestant will put ten gallons of his chosen fuel in a clean 45-gallon drum, stopper it, roll it fast for 50yd, up-end it, sit on it, remove the bung and drop a well-lighted taper through the bung-hole.

I will then invite any survivors to repeat the exercise on their JP.4 while I do a run on unweathered *aviation gasoline*. This should dispose of the fallacy that "anyway JP.4 is no worse than aviation gasoline" and its despicable corollary that registration authorities who sanction the latter should not prohibit the former. (In fairness it should be stated that gasoline, if extremely cold, can be as explosive as JP.4 is at normal temperatures; I therefore would stipulate ISA plus or minus 15°C for my run on aviation gasoline!)

Lord Brabazon's brilliant idea of challenging the advocates of JP.4 physically to stand by—or rather, in the middle of—their convictions, and Mr Rickard's excellent survey of the technical factors involved (*Flight*, June 10) have cleared the way for tackling the real and legitimate problem, which is an economic one: "... economics will eventually dictate the choice ..." said Mr Bass of Shell Petroleum in 1957 (*The Choice of Fuels for Turbine-engined Airliners*). His predictions appear to have been only too accurate. Let us take the briefest look at this economic aspect on the basis of a hypothetical price differential of one penny a gallon in favour of JP.4 (*pro rata* for any other differential).

A major statistical survey of ten years of scheduled civil air operations in the USA between 1947 and 1956, reported in *Aviation Week* for April 22, 1957, quoted the casualty rate as one fatality per hundred million passenger miles, approximately. Now suppose one out of every five fatalities was due to fire of the kind obviated by using kerosine. Then an airline choosing to use kerosine for safety reasons would have to produce 500 million passenger-miles to save that one life. At our penny a gallon price differential, this altruistic airline will incur £70,000 extra fuel costs for each life saved. (I've taken a jetliner carrying 100 passengers and consuming 3gal of fuel a mile as my basis; e.g., a Boeing 707.)

Can an airline afford £70,000 to save one human life? Or, would a passenger pay an extra 9s on his fare from London to New York for the extra safety of kerosine? I would. What about your readers? Please note that my supposition of one fatality in five, saved by kerosine, is a guess simply as a basis for doing the sum. If the realistic ration were one in ten, then the cost of a life saved would be £140,000 to the airline, equivalent to a ticket surcharge of 18s; and so on. And I would still pay it—particularly for relatives going by air.

May I emphasize in conclusion that my challenge is made in deadly earnest; that lives are at stake as I write; that the idea that there exist today "converts to JP.4" in any sense but an economic one is a dangerous fallacy; and finally that the real issue is one of hard cash and will have to be fought with appropriate weapons, i.e., those that touch the pocket, if we are to recover the ground already lost to the many airlines now using JP.4.

St Albans, Herts ROBIN PIERCY

P.S. My respects and gratitude to those airlines which stick to kerosine and have been impressively vindicated at La Guardia, LAP, Rome, Buenos Aires, and many other places.

Clement Ader's Flight

IN the issue of *Flight* for April 3, 1959, in an article entitled *Hops and Flights*, by C. H. Gibbs-Smith, Clement Ader is quoted as having made a flight of "about 50m" in his steam-powered Eole, at Armainvilliers, France, on October 9, 1890, after an unassisted take-off. Charles Dollfus is quoted as saying that this was "a very brief and not a sustained flight." It is often said that, for a flight to be claimed as the world's first powered flight, it must be proved to have been controlled and sustained. But surely Ader's flight could be described as the first powered flight, even if it was not the first controlled and sustained flight?

Are there in existence any photographs or drawings of Ader's Eole which you could publish?

Croydon, Surrey T. SERVIAN

[Mr Gibbs-Smith comments: "If Mr Servain would borrow a copy of his new book (*The Aeroplane: An Historical Survey*) he will find an exhaustive discussion of what is and is not a flight, of the Ader case, and (on page 311, Fig 46) a good drawing of the Eole. The short answer is that no authority would hold that such a brief uncontrolled sustentation can be called a flight in any serious meaning of the term. Control and reasonable distance covered is as essential in an aeroplane as in a bird, otherwise the word flight comes to have no meaning. We hold, with the French, that Ader made the first take-off under the power of the aeroplane itself, without acceleration aids."]

FORTHCOMING EVENTS

Nov. 11. RAeS and IEE (joint lecture): "The Future of Electrics and Electronics in Aircraft and Guided Missiles," by Viscount Caldecote.
Nov. 16. Kronfeld Club: Film Show.
Nov. 17. Guild of Air Pilots and Air Navigators: Annual General Meeting and Service.
Nov. 18. Institute of Navigation: Symposium on "Navigation for the Early Exploration of the Moon."
Nov. 18. RAeS: Sixteenth British Commonwealth Lecture, "The Story of Indian Air Transport," by J. R. D. Tata.
Nov. 19. Kronfeld Club: Film Show.
Nov. 20. Association of British Aero Clubs and Centres: Annual Dinner.
Nov. 21. RAeS Historical Group: "My First Ten Years in Aviation," by Sir Thomas Sopwith.
Nov. 22. BritIRE (Southern Section): "Radio Aids for Automatic Landing Developed by the Blind Landing Experimental Unit," by J. S. Shayler.
Nov. 22. BritIRE (South Western Section): "Transistors in Control Circuits," by E. Wolfendale.
Nov. 22. RAeS: "Basic Aerodynamic Considerations of V/STOL Aircraft," by P. L. Sutcliffe.
Nov. 23. BritIRE (South Wales Section): "Radio Navigational Aids in Aircraft." (Lecturer to be announced.)
Nov. 23. Kronfeld Club: "The Sea and Sailing," by Mike Gee and Frank Irving.
Nov. 23. RAeS Graduates' and Students' Section: "The British Space Programme," by M. O. Robins.
Nov. 23. Society of Environmental Engineers: Discussion on "Vibration Testing and Instrumentation of Large Stores."

RAeS Branch Fixtures (to Nov. 18): Nov. 14, *Henlow*, "Accident Investigation," by P. G. Tweedie. Nov. 15, *Luton*, "Certification of Aircraft in the USA," by K. H. Greenly. Nov. 16, *Christchurch*, "The Design of the C.N.7 and the New Land Speed Record," by L. H. and K. H. Norris; *Coventry*, "Flight Development of Modern Production Aircraft," by C. F. Bethwaite; *Southend*, Film Show. Nov. 17, *Cheltenham*, "Air Traffic Control," by F. J. Low.

THE INDUSTRY

Facilitating Engine Removal

WELL known in America and on the European Continent —where they are in use with NATO air forces and a number of airlines—are the "aircraft ground-support systems" made by Air Logistics Corporation of Pasadena, Calif. Broadly speaking, this is a range of equipment designed to facilitate removal and replacement of aircraft and missile major assemblies and to provide a means of transporting them quickly and easily into maintenance hangars; in many instances the transporters themselves are also used as maintenance stands. Now comes news that one of the basic items of this equipment, the Air-Log engine-removal trailer, is to be manufactured in this country by the firm of Air-Log Ltd, which is a member of the Braby of Britain Group (who, incidentally, are also the subject of an "In Brief" paragraph below).

The equipment was demonstrated at London Airport last week to a number of Service and airline representatives in BOAC's Boeing 707 maintenance hangar, where the Corporation had made a Conway engine available for the purpose. The principal aim of the design is to render unnecessary the use of overhead hoists for removing powerplants and to substitute a two-man system by which the engine is first supported on a sturdy trolley, then detached and disconnected from its nacelle or pod and finally lowered clear of the aircraft preparatory to being wheeled away, either on the trolley itself or on a subsidiary trailer which may also be used for ground servicing of the engine or as a storage cradle.

As the weight which it has to bear would imply, the trolley —which is mounted on four pneumatically tyred wheels—is of extremely robust construction, heavy forgings being extensively used. It consists basically of two sections, (a) a ground chassis and (b) a rail-and-cradle assembly which can be raised and lowered. In operation, the two parallel load-bearing rails carry cradles which are in practice adaptors of various types made to fit particular engines. To remove an engine, the trolley is positioned underneath the nacelle or pod and the rails raised to the required height by means of hydraulic jacks operating jack-knife members. Hydraulic power can be provided either by a hand pump or by an electrically operated power-pack mounted on the chassis. The rails, and therefore the cradles which they carry, are adjustable in two planes and also in roll, so that they may be precisely positioned. They are raised until the full weight of the engine is transferred, and the attachment bolts can then be removed and the pick-up points pinned to the cradle attachments. Pipelines and other connections to the engine having already been removed, the rails can then be lowered until the engine is clear of the nacelle or pod and the trolley can be moved away. The chassis itself can also be depressed hydraulically in relation to its wheels, so that the loaded trolley has a very low centre of gravity.

The engine-lift trolley demonstrated by Air-Log Ltd at London Airport, carrying a Rolls-Royce Conway 509

The trolley can either be used as a transportation trailer itself or, if it is required immediately in another removal or replacement operation, the engine can be transferred to a subsidiary trailer unit of simple construction, consisting of little more than a pair of rails carried on a four-wheel undercarriage. To perform the transfer operation, the trolley and trailer rails are aligned and locked together. Then, the adaptor cradles having been unlocked from the rails, they are slid along, motion being imparted by means of small rollers operated by socket wrenches. When they are correctly positioned on the trailer they are locked by clamps.

If an engine is to be brought to an aircraft and installed, the same procedure is followed in reverse.

IN BRIEF

Work has started on the first stage of the new electronics factory being built at Rochester for Elliott Brothers (London) Ltd.

Mr John Wotton, MIMechE, AFRAeS, has joined the design team at Vickers-Armstrongs (Aircraft) Ltd, Weybridge. He was formerly with Hunting Aircraft, having become assistant chief designer in 1955.

Negretti & Zambra Ltd have published an Indian version of their general catalogue of industrial and scientific instruments. This is being circulated throughout India and Ceylon by their Indian agents, Bell's Asbestos & Engineering (India) Private Ltd, 34 Chittaranjan Avenue, Calcutta 12.

Joseph Lucas Ltd have announced changes of title for two companies in the Lucas organization. Joseph Lucas (Hydraulic & Combustion Equipment) Ltd is now known as Lucas Industrial Equipment Ltd; and Joseph Lucas (Gas Turbine Equipment) Ltd as Lucas Gas Turbine Equipment Ltd.

The Braby of Britain Group have announced the election of Air Cdre James Warburton to the board of Frederick Braby & Co Ltd. A director of Auto Diesels Ltd, one of the group's companies, Air Cdre Warburton is in charge of the newly formed aircraft equipment division at Braby House, Smithfield Street, London EC1.

Mr C. G. T. Hyslop retired from the board of Birfield Ltd on October 19 on reaching the age of 70, as required by the company's articles. He will, however, continue to be chairman of three companies in the Birfield Group, The Phosphor Bronze Co Ltd, Kent Alloys Ltd and R. Jones & Co Ltd.

Improved Series 80,000 digital-display units produced by Counting Instruments Ltd, 5 Elstree Way, Boreham Wood, Herts, now display words back-lighted with colour. This is achieved by rear projection, the unit containing a master condenser lens with 12 individual positions; the desired word, message or colour is printed on each lens.

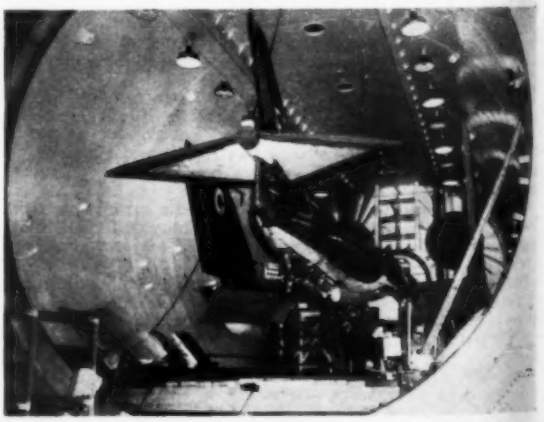
Pye Industries Ltd of Australia and Petbow Ltd, Sandwich, Kent, have announced the joint formation of an Australian company, Petbow Pty Ltd. Operating from premises at 288 Huntingdale Road, Huntingdale, Victoria, the Australian concern will gradually extend its operations to cover the whole range of Petbow products and also the manufacture of Magnicon alternators under licence to the Macfarlane Engineering Co Ltd.

A new Dowty Group company, Dowty Technical Developments Ltd, has been formed to undertake advanced project work for the group. Board members are Sir George Dowty (chairman), Mr T. D. H. Andrews (managing director), Mr D. G. A. Thomas and Mr J. E. Price (secretary). The company, which brings the total number of Dowty subsidiaries to twenty-two, will operate from Brockhampton Park, Andoversford, Glos. Dowty have also announced that the name of Dowty Nucleonics Ltd has been changed to Dowty Electrics Ltd.

Mr G. P. Green has been appointed press liaison officer of the Martin-Baker Aircraft Co Ltd as from November 1.

Mr Andrew N. Combe, MIWS, has been appointed chief planning engineer of Aeropreen Ltd, High Wycombe, Bucks. This newly created post is the third of senior executive rank to be announced by the company in the last three months.

Mr C. P. Dotson, chairman of Texas Instruments Ltd, announced last week that he has regretfully accepted the resignation of Mr Dudley Saward from the post of managing director. Mr A. N. Provost, who has had extensive electrical engineering experience in America, has been appointed to succeed him. Mr Saward, who was Chief Radar Officer of Bomber Command from 1942 until 1945, is resigning in order to devote more time to other activities but will remain a director of Texas Instruments.



A Scimitar undergoing low-temperature tests in the stratosphere chamber at Vickers-Armstrongs (Aircraft) Ltd, Weybridge. The chamber, which has been in service since 1951, is insulated to an overall thickness of 12in with Onazote the expanded-ebonite material —which is highly moisture-resistant—made by the Expanded Rubber Co Ltd, Mitcham Road, Croydon, Surrey

XEROX